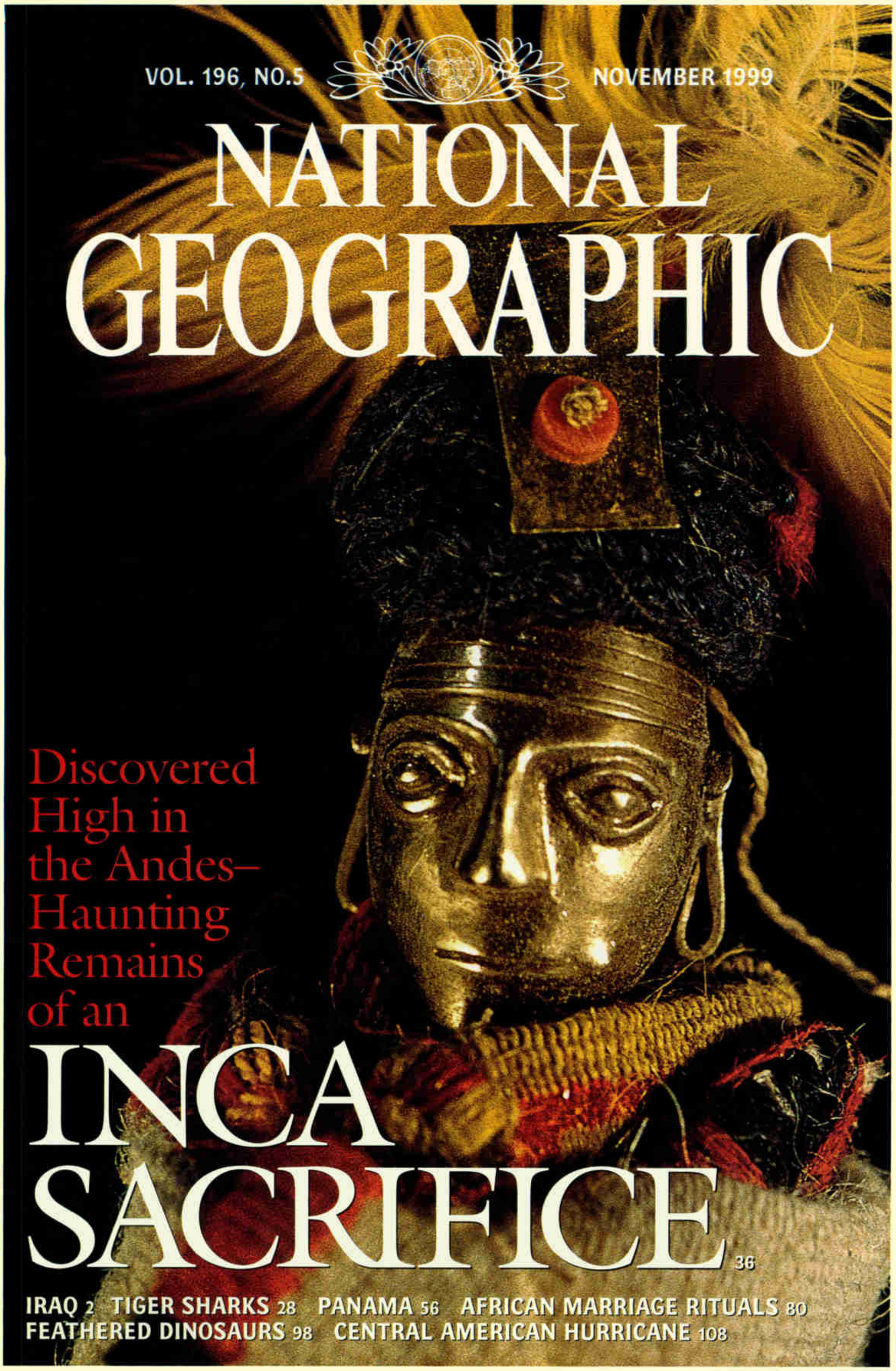
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NATIONAL GEOGRAPHIC



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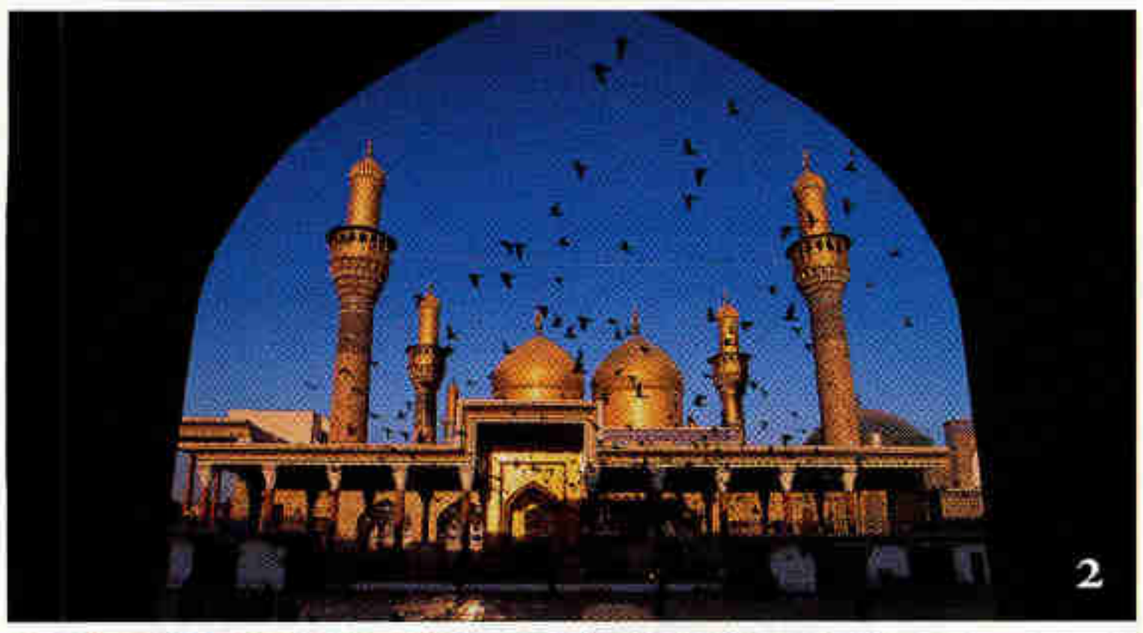


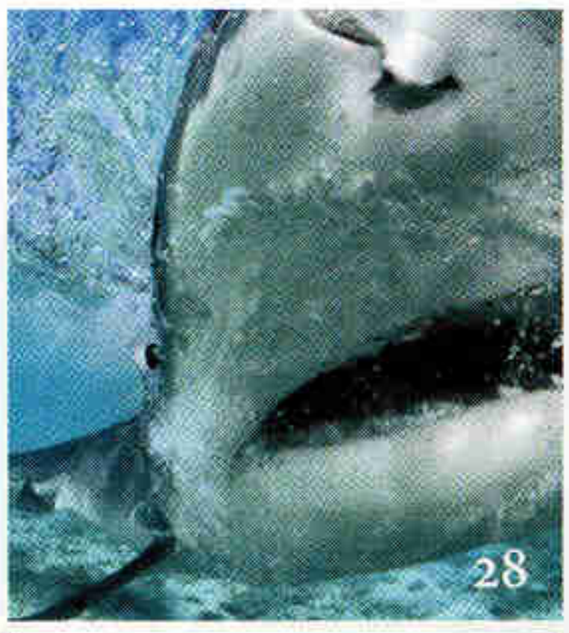
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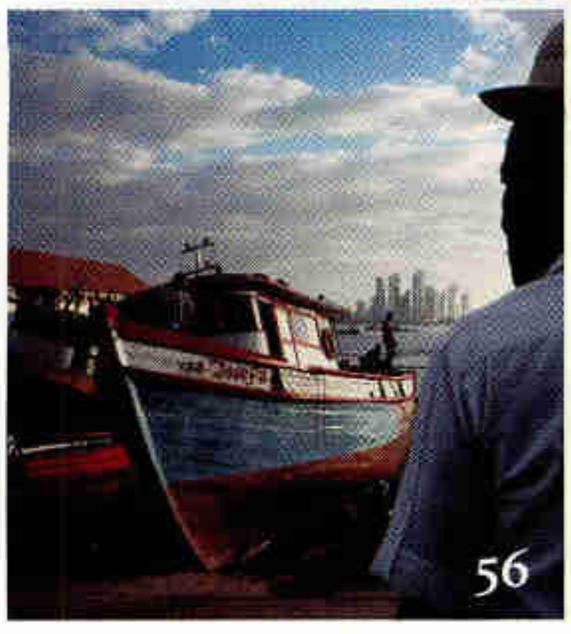
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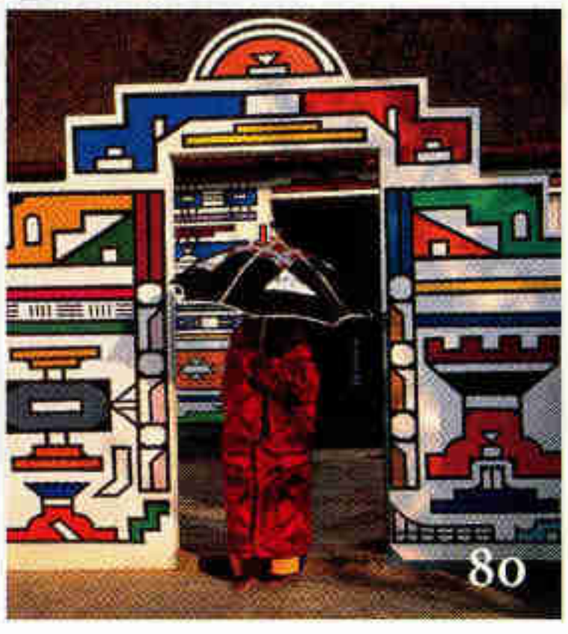
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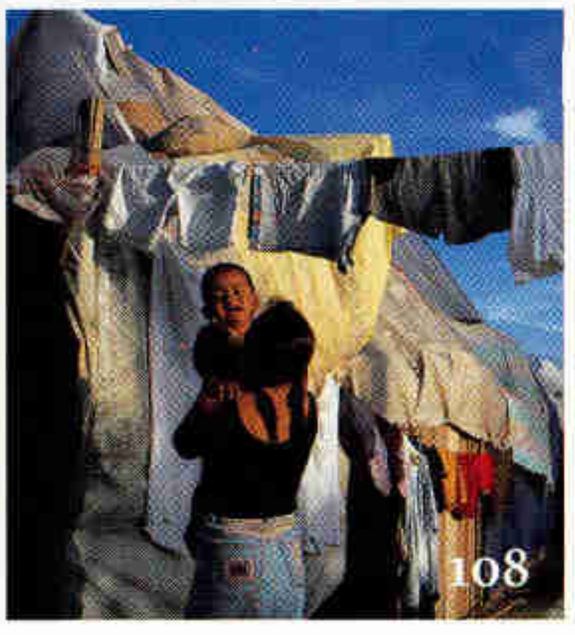












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108 **After the Deluge** *Already sodden at the end of the rainy season, Central America was ripe for disaster when Hurricane Mitch struck last fall. Survivors recall the Atlantic's deadliest tempest in two centuries.*
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The Cover

Clothing intact, this gold figurine was found with the exquisitely preserved mummy of an Inca boy sacrificed 500 years ago on an Andean peak in present-day Argentina. Photograph by Maria Stenzel

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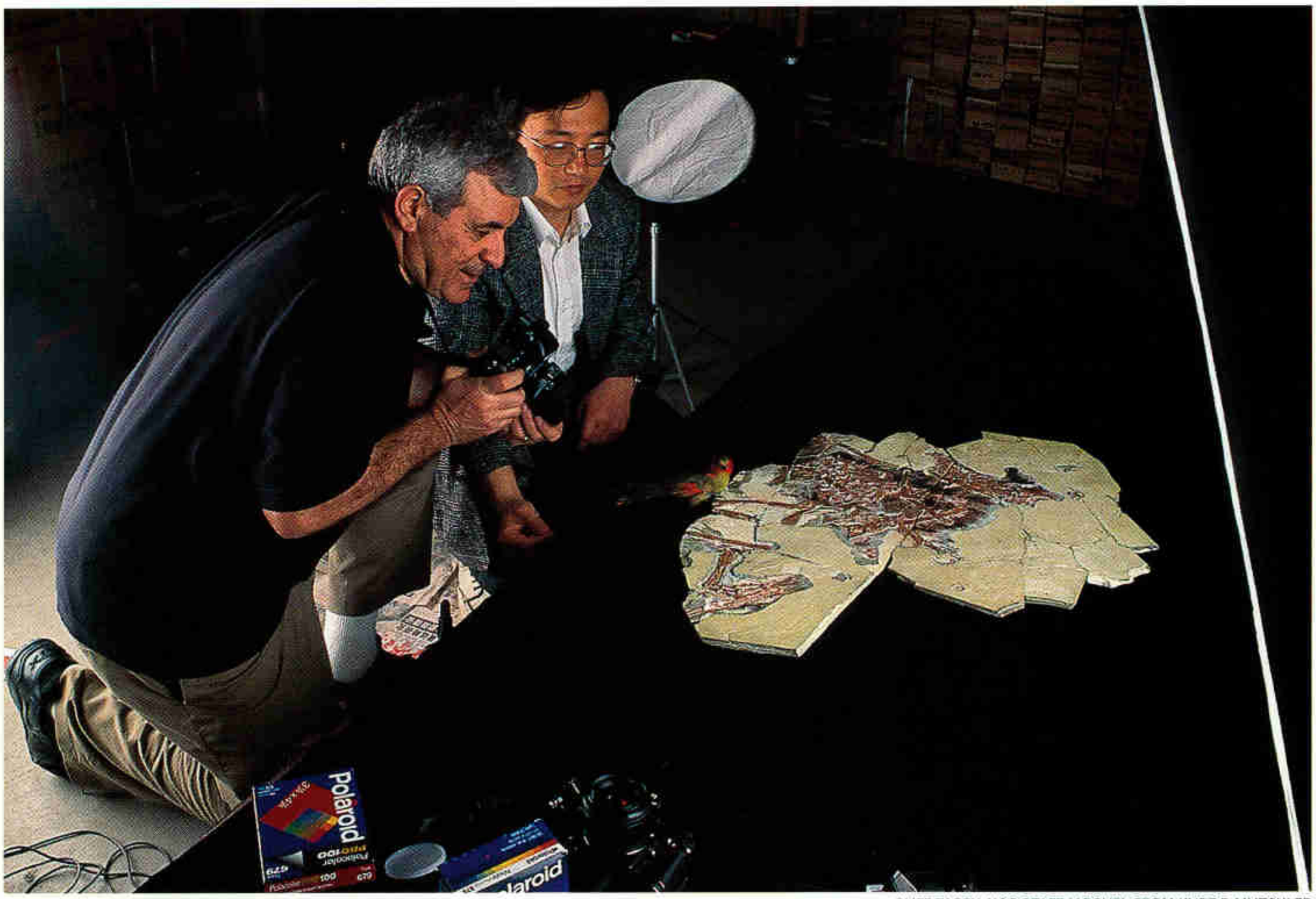
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CLIFF TARPY, NGS STAFF (ABOVE); FROM KURT F. MUTCHLER

■ FEATHERED DINOSAURS

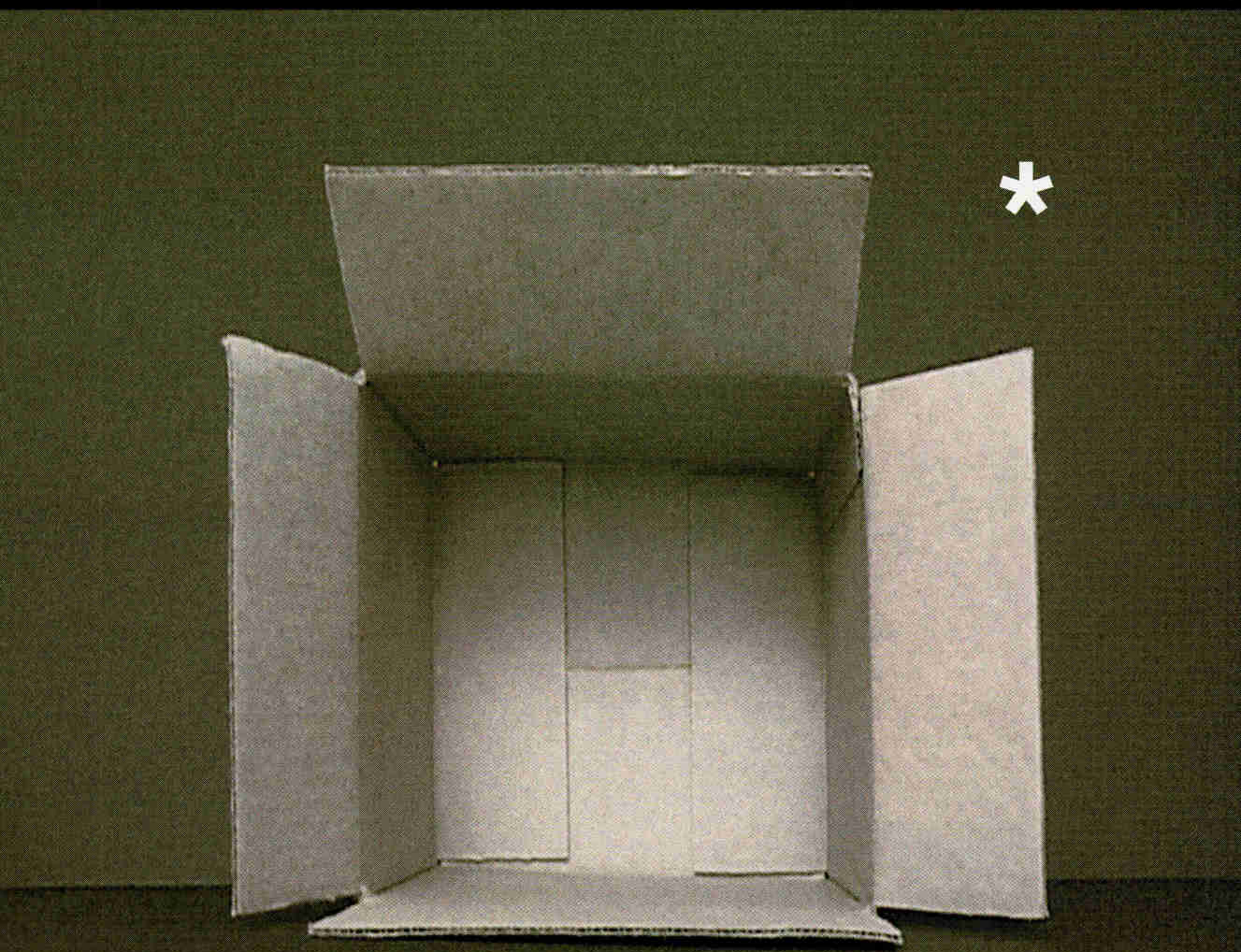
Winging It

Did dinosaur feathers lead to flight? For the team working on our article they sure did. "This story was always in motion. We kept rushing off to check out new discoveries," says the author, Senior Assistant Editor Chris Sloan (below, at left). Chris's efforts led him to places from Utah to Ulaanbaatar. He and Illustrations Editor Kurt Mutchler, at center, traveled to Beijing to discuss some of these newly found fossils with Chinese experts.

"One of the fossils we heard about was a dinosaur in Mongolia that had a pygo-style—the fused vertebrae that supports a bird's tail feathers. It's an important find, but I kept thinking, 'This bone is probably as big as my thumb. I hope it's worth the trip.'" It was; the fossil that Mongolian paleontologist Rinchen Barsbold, at right, showed them was not just the tailbone but a nearly complete dinosaur.



Tracing Chris and Kurt's footsteps, photographer Lou Mazzatenta (above, at left), here with interpreter Gao Jian, shot a dromaeosaur fossil, *Sinornithosaurus*, at Beijing's Institute of Vertebrate Paleontology and Paleoanthropology. Making flat pieces of rock come to life for the camera is no easy task. "I brought a whole photo studio to China with me," admits Lou. For the session above, he used sidelighting to display the bones in better relief and a red-faced songbird (later adopted by a paleontologist) to add a reference to its ancient ancestor. "Poor little bird," says Lou. "We never used its photo."

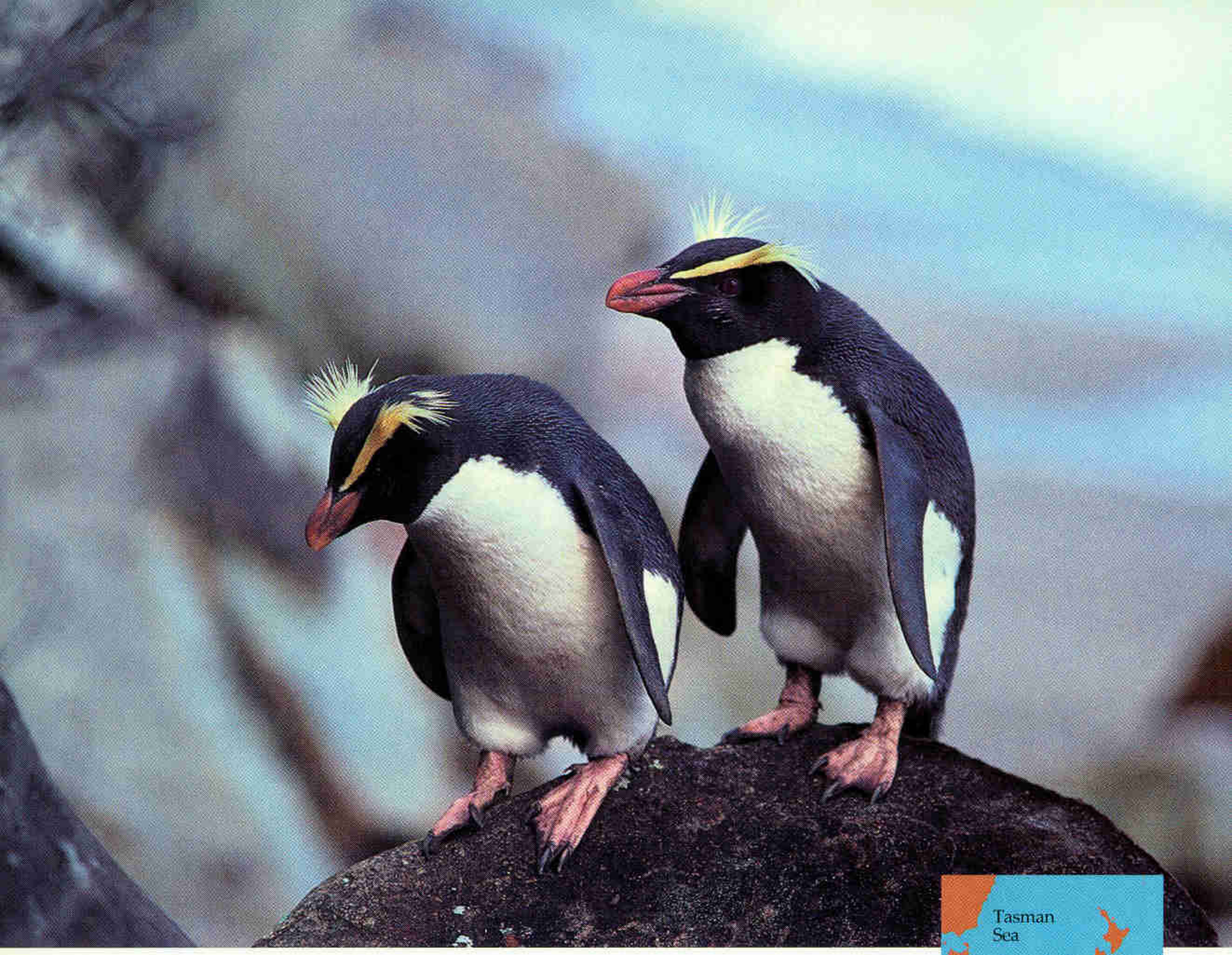


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Fiordland Crested Penguin *(Eudyptes pachyrhynchus)* **Size:** Stands 40 cm **Weight:** Approx. 4 kg **Habitat:** Temperate waters and southwest coastlines of South Island, New Zealand, and several offshore islands
Surviving number: Estimated at 2,500-3,000 breeding pairs Photographed by Tui De Roy

WILDLIFE AS CANON SEES IT

After months at sea, Fiordland crested penguins land along the rugged coastlines of southwest New Zealand and journey inland up densely forested slopes to begin their nesting season. Alone or in small scattered groups, pairs build nests sheltered from rainfall and storms. Two eggs are laid, but the larger, second egg usually produces the stronger and only surviving chick. Both birds care for the hatchling for some 75 days; it then departs for the sea, followed shortly after by its parents. Fiordland crested penguin chicks and eggs are vulnerable to predation by introduced stoats and rats, as well as dogs and the native weka. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

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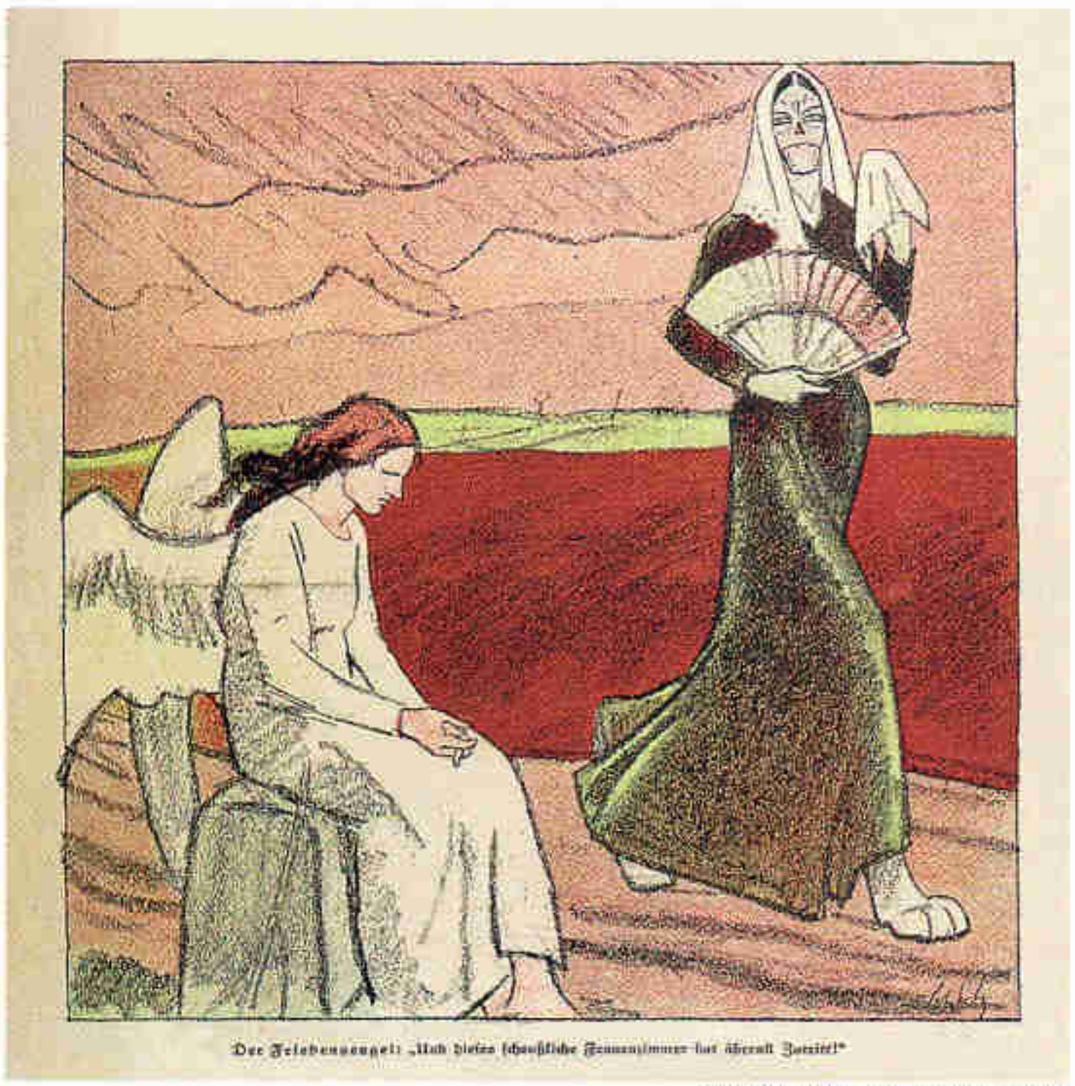
NATIONAL GEOGRAPHIC
Geographica



Off the English Coast, a Seaside Stonehenge

Some called it Seahenge: One oak trunk sat upturned, and 55 others formed a 22-foot circle around it. Nearby lay a bronze ax, perhaps used to hew the timbers. For 4,000 years the circle was buried under, and protected by, a three-foot layer of peat. Last year the North Sea washed away the peat and exposed the site near the town of Holme next the Sea in England. "Here we see a British Bronze Age religious structure of timber for the first time," says David Miles, chief archaeologist for English Heritage, England's preservation agency. Fearing the trees would disintegrate, English Heritage removed them—despite protests by locals—and sent them to a conservation lab.

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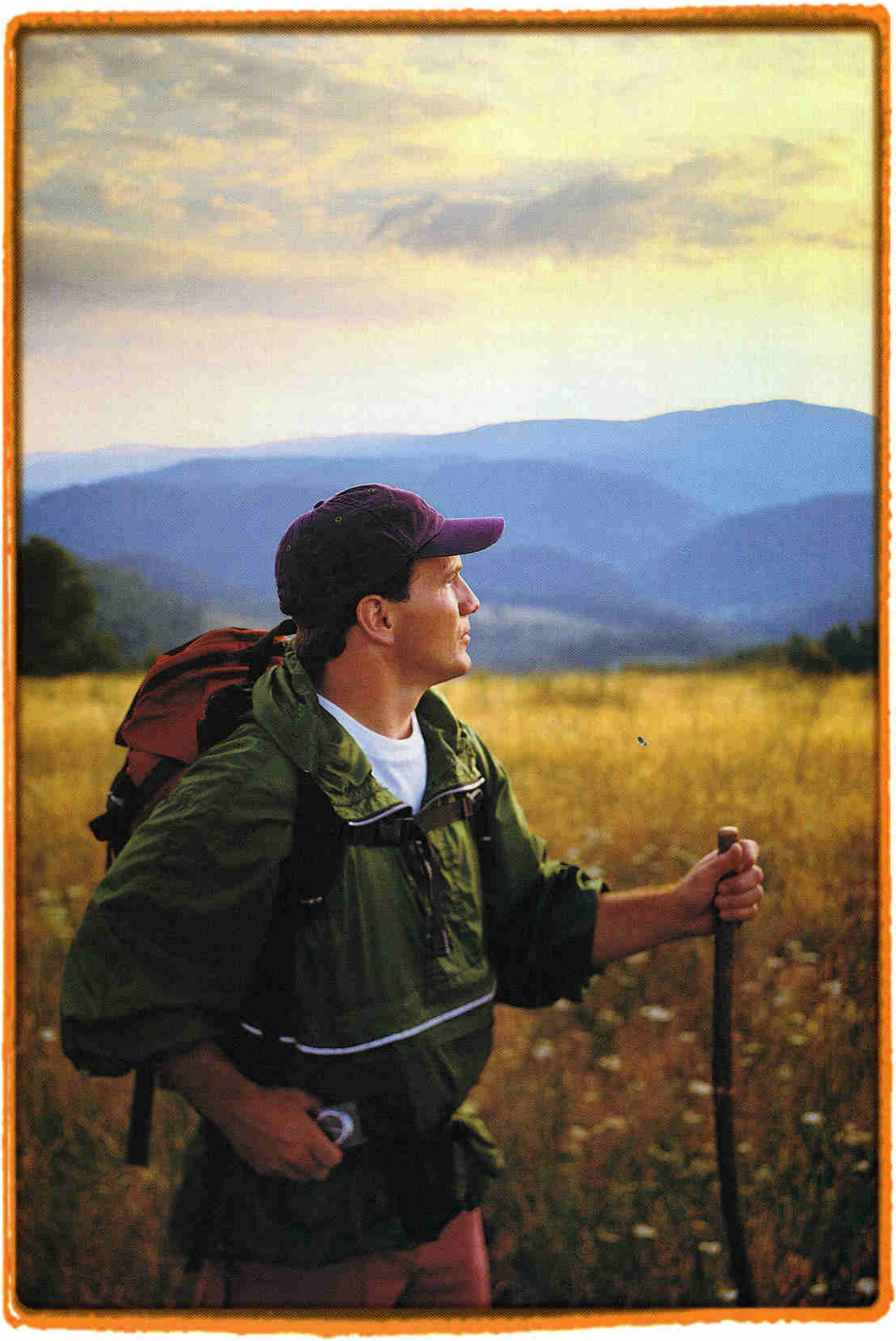
Der Todesengel: „Ach diese schauliche Frauenzimmer hat überall Zutritt!"

MARY EVANS PICTURE LIBRARY

A Virus That Caused a Calamity

Two were soldiers, one stationed at Camp Jackson, South Carolina, the other at New York's Camp Upton. The third was an Inuit woman buried on Alaska's Seward Peninsula. All three died in the 1918 worldwide flu epidemic that killed at least 20 million people, causing the lamentation depicted in this drawing from a German magazine (left).

Analyzing tissue samples from the trio, scientists at the Armed Forces Institute of Pathology have sequenced three of the 1918 flu virus's eight genes. The viruses that caused the century's other major flu pandemics, in 1957 and 1968, had immediate catastrophic effects when they moved from birds to humans. This one may have been latent in mammals for some time before it began to infect people on a massive scale. Researchers eventually hope to learn what made the 1918 strain so lethal.



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ART BY JENNIFER C. CHRISTIANSEN, NGS STAFF

Hidden Meanings in Quilt Designs

For years Raymond Dobard sought a link between quilts made by slaves and the Underground Railroad (GEOGRAPHIC, July 1984). Now the art historian at Howard University in Washington, D.C., and University of Denver writer Jacqueline Tobin think they've found a long-secret quilt "code" that helped guide escaped slaves from the Carolinas to freedom.

Ozella McDaniel Williams, an elderly quilter in Charleston, South Carolina, said the code—using patterns like those in the composite image at left—has been family lore for generations. Williams, who died last year, said escape organizers would air out a quilt with the Monkey Wrench pattern (bottom right) to alert potential escapees to gather up tools and prepare to flee or a Drunkard's Path quilt (top right) as a warning for escapees not to follow a straight route.

Dobard and Tobin decipher the code in their book, *Hidden in Plain View.* "This was not the only code," Dobard says. Other secret messages and Underground Railroad lore can be found online at *www.nationalgeographic.com/railroad.*

■ NGS RESEARCH GRANT

In Ancient Turkey, Rank Had Its Privilege

Rusa II, the last great king of Urartu, a rival of Assyria, built a hilltop citadel at Agarti in Turkey about 650 B.C. Excavations of the fortress since 1989, led by Altan Çilingiroğlu of Turkey's Ege University, have uncovered a major tower temple, cuneiform inscriptions, storerooms, and decorative bronzes like this lion's head (right). Now, in the nearly 200-acre site surrounding the fort, Paul Zimansky of Boston University and Elizabeth Stone of the State University of New York at Stony Brook have found individual homes near the citadel that are unlike the cramped housing complexes they unearthed farther downhill. Upslope residents also had finer pottery, and bones in their garbage dumps show that they ate better cuts of meat than the lower classes. "The higher up you go, the wealthier it gets," Zimansky says.



PAUL ZIMANSKY

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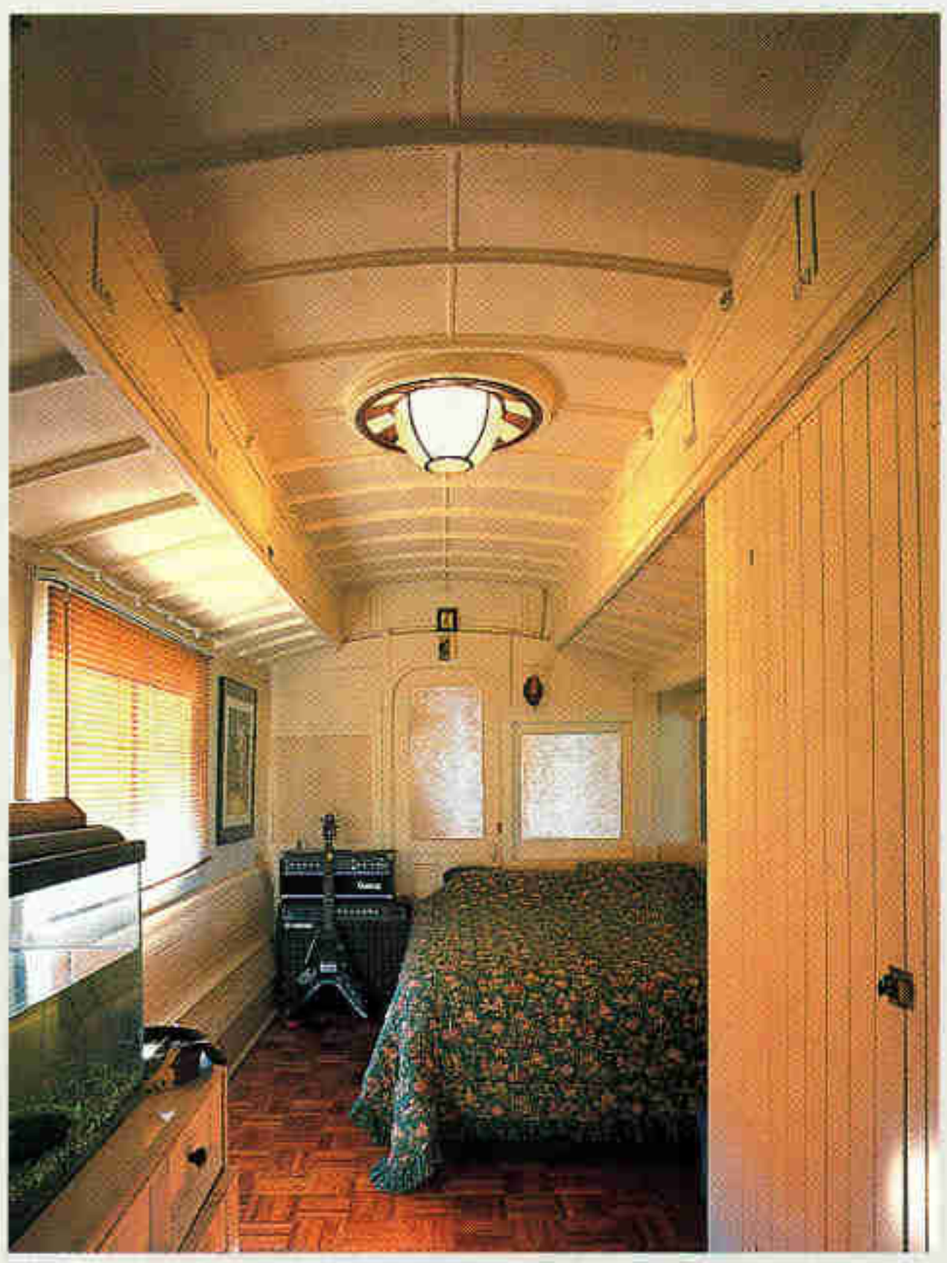
Cable Carville Lives On in Memory

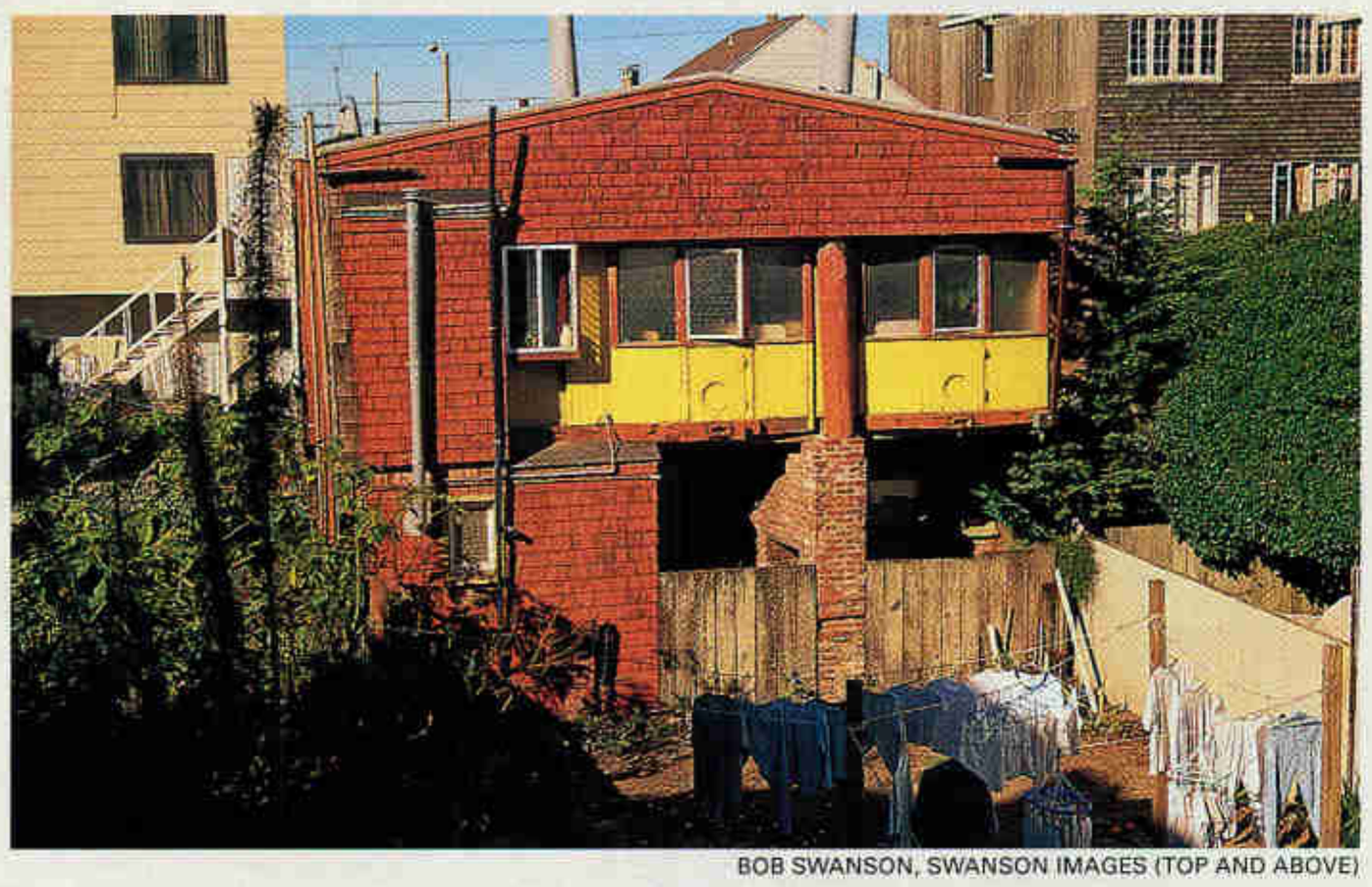
Pat Halloran barely slept the first night he spent in his San Francisco apartment. "I thought it was going to move," says the painter and printmaker. No wonder: His bedroom is in an old streetcar (right). Benches line the walls there and in his living room, which is made up of two cable cars.

The apartment—raised earlier this century to become the second story of a more conventional home (center)—is a vestige of a once thriving community named Carville (bottom). It began to take shape in the 1890s after cable cars replaced horse-drawn streetcars, which were dumped haphazardly on oceanfront dunes south of Golden Gate Park. Some of the cars were turned into clubhouses, shops, and homes favored by an arty, sometimes eccentric crowd. After the 1906 earthquake, damaged cable cars were added to the mix.

"Like the story of Topsy, it just grew," a city journalist wrote in 1908 of "the odd city on Ocean Beach," as one headline called it. By then it was home to 2,000 residents. Carville's heyday soon ended as more orthodox homes were built. Most car-houses had been destroyed by 1913, and today only a few remain.

But their evocative power is strong. In 1998 Halloran's landlord prevented a neighbor from gaining approval for an addition, successfully arguing that it would spoil the public's view of his historic Carville survivor.

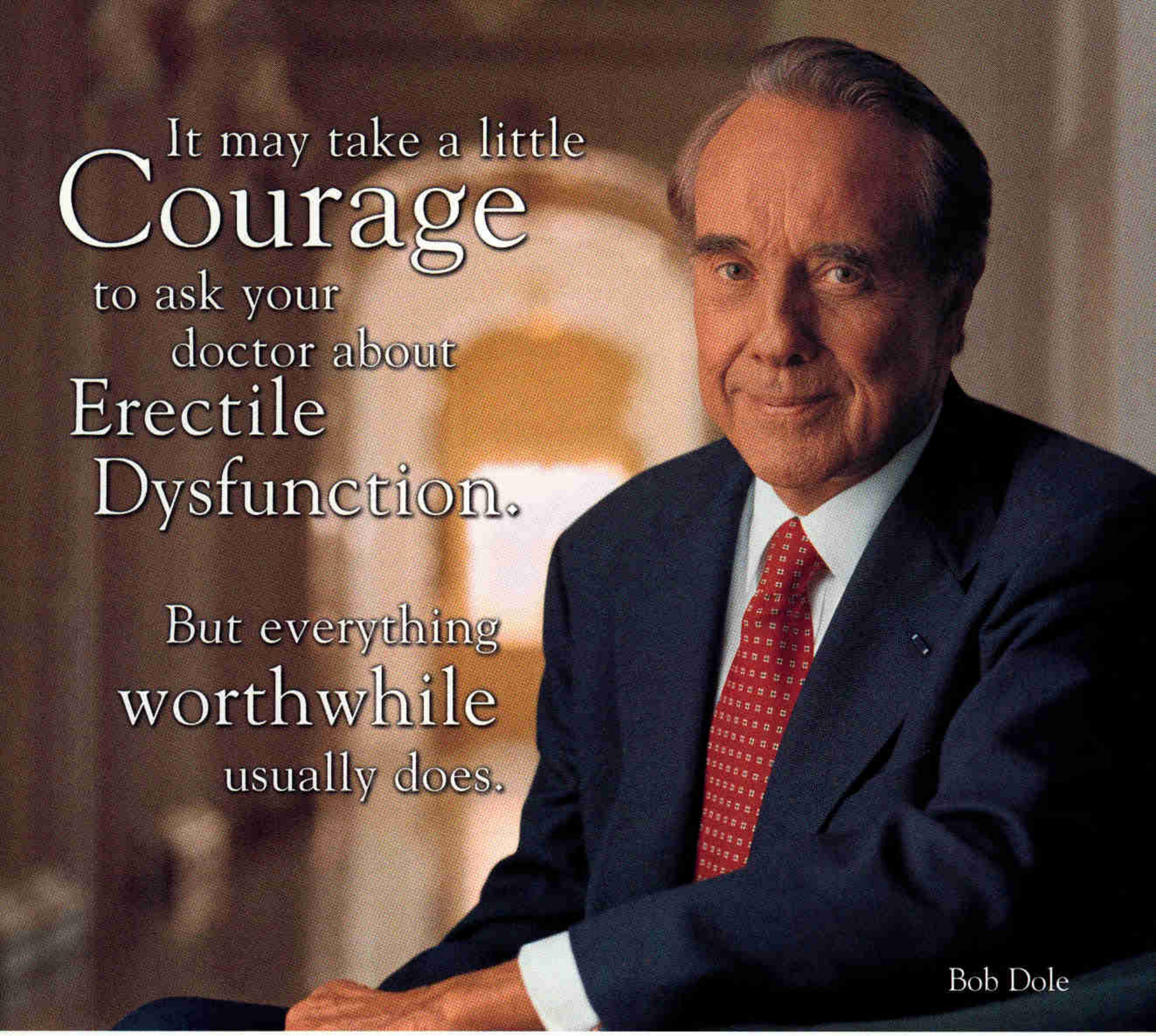




BOB SWANSON, SWANSON IMAGES (TOP AND ABOVE)



MARILYN BLAISDELL COLLECTION



When I was diagnosed with prostate cancer, my first concern was ridding myself of the cancer. But I was also concerned about possible postoperative side effects, like erectile dysfunction (E.D.), often called impotence. So I asked my doctor about treatment options.

I'm speaking out now in the hope that men with E.D. will get proper treatment for a condition that affects millions of men and their partners.

Most E.D. cases are associated with physical conditions or events, like the prostate cancer surgery I underwent. The most common causes of E.D. include diabetes, high blood pressure, spinal cord injury, or surgery for the prostate or colon. E.D. can also be associated with smoking, alcohol abuse, or psychological conditions such as anxiety or stress.

The good news is that many effective treatments are available for E.D. But the important first step is to talk to your doctor. Together, you and your doctor can decide which treatment is best for you.

Now it's up to you to get the treatment you need for E.D. My advice is to get a medical checkup. It's the best way to get educated about E.D. and what can be done to treat it. It may take a little courage, but I've found that everything worthwhile usually does.

For more information about erectile dysfunction, please call 1-800-433-4215.

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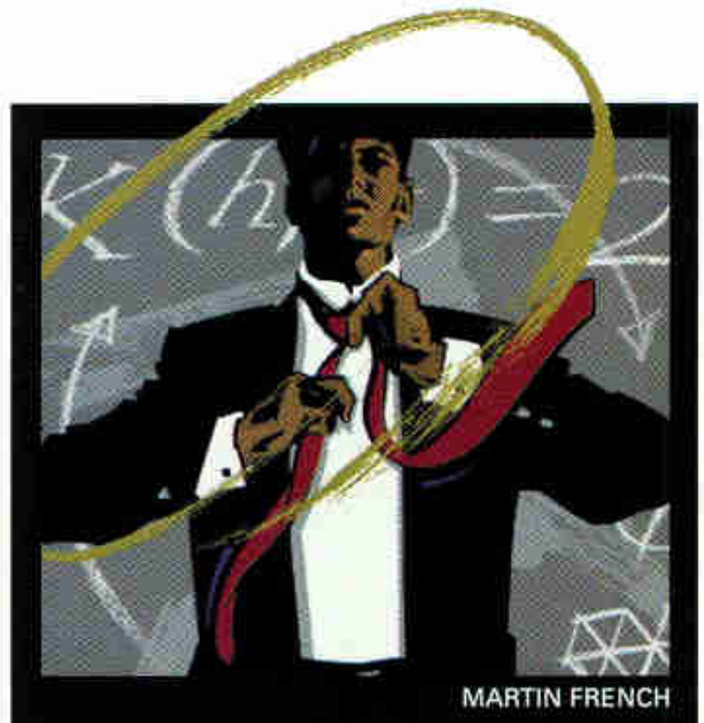


STEVE RAWLS

A Rodeo Honors Working Cowhands

Bob Moorehouse has the highest respect for athletes who compete in professional rodeos (GEOGRAPHIC, September 1999). But Moorehouse, general manager of the 170,000-acre Pitchfork Ranch in Guthrie, Texas—"and lucky enough to say I'm a cowboy too"—knows "a lot of them aren't really cowboys; they don't live on a ranch."

Moorehouse is a board member of the Working Ranch Cowboys Association (WRCA), whose fourth annual world championship rodeo is being held this month in Amarillo, Texas. Pro rodeos emphasize individual competitions, but the WRCA sponsors cooperative events like cattle doctoring, wild cow milking, team penning, and team branding (above). "We try to get back to the true cowboy, the traditions of what it's all about," Moorehouse says. "We like it the way it was, even though I've got a laptop computer six inches from me."



MARTIN FRENCH

A Knotty Problem

Four knots have come into common use since neckties became fashionable a century ago. Physicists Thomas Fink and Yong Mao of England's Cavendish Laboratory set out to learn how many ways you can manipulate a tie's wide end around the narrow end in nine or fewer moves. Mathematical modeling revealed the answer: 85. But only 13, including 9 new ones, were aesthetically pleasing. Fink uses two of the new knots when tying his own ties.

From Wild Blue Yonder to Speedway

The Langley Full-Scale Tunnel in eastern Virginia was the world's largest wind tunnel when it opened in 1931. Orville Wright frequented the place; NASA's Mercury capsule underwent tests there. But the high cost of running it, budget cuts, and construction of an even larger facility at Ames Research Center in California led NASA to halt operations in 1995.

Now the 2.2-acre National Historic Landmark has a new operator, Old Dominion University, and a new job: testing NASCAR race cars (GEOGRAPHIC, June 1998). Engineers, crew chiefs, and builders of cars like those of Rusty Wallace and Jeremy Mayfield (below) ship vehicles to Langley so that aerodynamics students can put the cars through their paces.

"The name of the game is decreased drag, increased down force," says Jim Cross, an ODU professor and the tunnel's manager. "The race car teams try to find ways to manage those forces to improve their track times."

TEXT BY BORIS WEINTRAUB



CHUCK THOMAS, OLD DOMINION UNIVERSITY

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Forum

The July issue "was a celebration of color that is sure to captivate many new admirers of the natural beauty in our planet," wrote a reader from Singapore. Praising our Iran story, a teacher of English as a second language commented: "It is very important to be sensitive to the native cultures of my students. NATIONAL GEOGRAPHIC *helps me do this."*

Iran: Testing the Waters of Reform

As one long involved with Iran, I compliment Fen Montaigne for the insight into Iran and the psyche of its people; seldom are Western observers (or Iranian, for that matter) so astute and articulate.

JAMES WHITAKER
Gold River, California

Your cover did your readership the great disservice of linking Iran with the outdated notion of the mysterious Orient and harem dancers. It deserves better representation than a fantasy movie image. After so many years of ignoring this great country, your article is disappointingly shallow.

ERIKA LOEFFLER
Kalamazoo, Michigan

Unfortunately many publications have forgotten that Iran exists, and if they do include an article on the country, it is rarely their feature story and certainly does not make the front cover. Of course, there are many aspects of Iran that need dramatic change and improvement. However, positive contributions like your article achieve more progress than shut-out policies, which simply increase isolationism and antagonism. Thank you for chipping away at the "intellectual sanctions."

BAHRAM POURGHADIRI
London, England

Mars on Earth

As a perceptual scientist I was fascinated by Michael E. Long's report of size misperceptions where, for example, an arctic hare was momentarily mistaken for a polar bear or a marmot for a grizzly (pages 46-7). However, the explanation that "the monotonous, treeless terrain offers few cues for perspective, and things can appear larger than they are" is incomplete. I suspect the observer's anxiety about keeping away from dangerous animals, the reduced depth information in such terrain, and the similar shapes and colors all combine to cause misperception of a large animal at some far distance.

GORDON M. REDDING
Bloomington, Illinois

On page 51 the author states, "I know that it is likely that no other human being, except for a few of the expedition members, has ever stood at this spot." Devon Island is the largest uninhabited island in the world, but there is ample evidence of people visiting and living on it going back as far as the Paleo-Eskimo period, about 4,000 years ago. I would think that it is likely that all sorts of people have stood on that spot during the past four millennia. It's important not to discount the significance of ancient cultures in our modern perspective.

STEVE IRVINE
Wiarton, Ontario

I am an all-terrain vehicle (ATV) safety instructor who has trained approximately one hundred students in the past ten years. The article stated that the expedition riders had a brief introduction to the ATVs and were set loose, so to speak. I also noticed that no one was wearing head protection. Even though an ATV is used as a recreational "toy," it is something that has mass and weight and can go fast. Many people have been killed or badly injured because of lack of training.

WAYNE BAXTER
North East, Pennsylvania

The Shrinking World of Hornbills

Your article made me think back to the time when I was a young boy living in the highland jungle in Laos. On one occasion when I was with my parents while they were planting rice, I had the privilege to behold the magnificent hornbills. The rice field (a clearing in the jungle) was several hours walking distance from the village. I would stay in a farm hut while my parents were out working in the field. From within, the hornbills' powerful wings could be heard overhead, even though the birds were several hundred feet above me. I would venture out to see a half dozen with their distinct stripes (just like the picture on page 62). There were so many mysterious sounds in the jungle, but none as memorable as those of the hornbills. That was 30 years ago. I wonder if their domain has shrunk so significantly that an experience like that would be rare today.

KHOUA THAO
Wichita, Kansas

Having studied hornbills in central Africa for the past seven years, we at the Center for Tropical Research hold these birds near and dear to our hearts. Our data from Cameroon show that just two species of hornbills disperse the seeds of roughly a quarter of the tree species in the Dja Reserve. With the other major seed dispersers—primates—suffering massive population declines due to poaching, the hornbill's ecological role is increasingly significant. Unfortunately, the hornbill is facing a similar population crisis. We've recently begun to see them sold for food in local markets.

TOM SMITH, *Executive Director*
AARON FRENCH, *Research Fellow*
San Francisco State University
San Francisco, California

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I look at them and see two sisters connected by more than blood and shared existence.

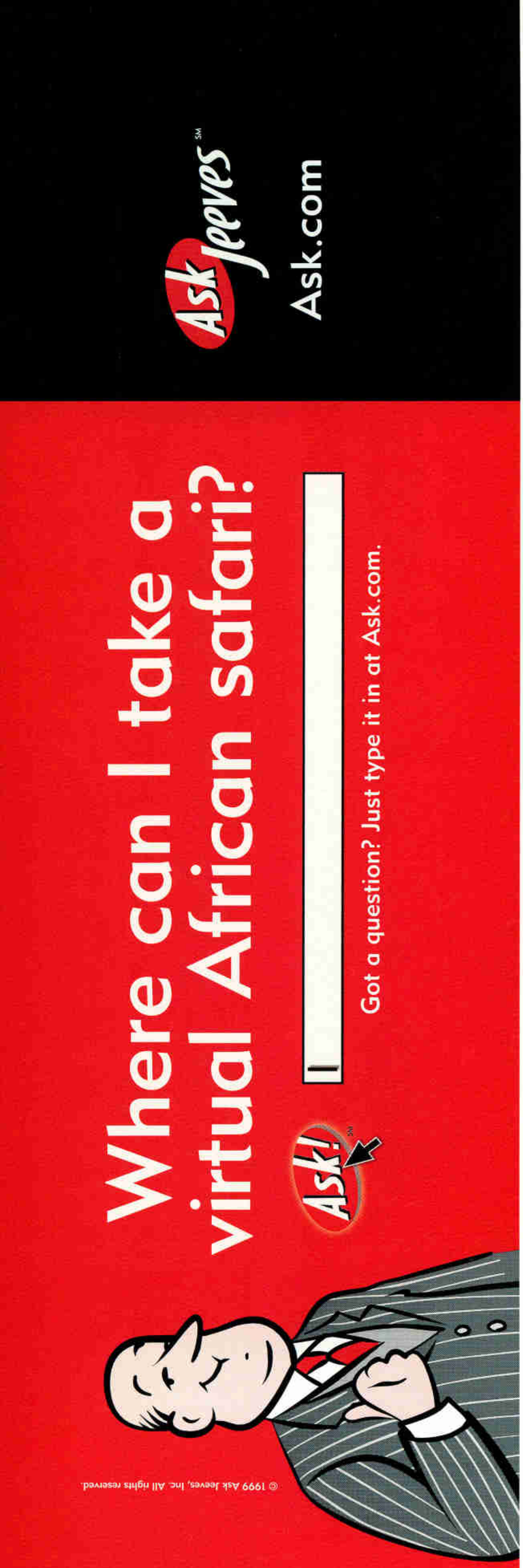
Two sisters who will draw strength and encouragement from each other as they move through life.

I look at them and see two sisters, two lovely daughters, and wonder what have I unleashed upon the world?

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The Quest for Color

The same phenomenon—thin-film interference—that gives oil slicks and soap bubbles their sheen is responsible for the bright blue colors of *Morpho* butterflies (page 79). The butterfly's color is more vivid than the soap bubbles' because its scales contain several alternating layers of air and a transparent material, chitin, rather than just a single layer. By the way, if you place a drop of oil on a *Morpho* wing, the oil seeps into the air space between the chitin layers and destroys this effect, turning the lovely blue wing into a dull black one.

DANIEL W. KOON
Canton, New York

Your fine article mentioned Tyrian purple, extracted from the shellfish *Murex trunculus* (page 81). In the Book of Numbers the Israelites are commanded to wear a thread of blue on the corners of their garments. While Jewish tradition has always held that this dye was derived from an animal, the exact source was lost over the years, and only white threads were worn. Recent research, however, has pointed to *M. trunculus* as having been the source, and in the past few years Jews have begun to wear blue threads made with this dye once again.

NACHUM LAMM
Flushing, New York

Celebrating Canyon Country

I find the statement on page 98 that "the primitive condition of all the country . . . apparently was going to be respected by the BLM, an agency not ordinarily dedicated to the wilderness ideal," to be misleading and offensive to the Bureau of Land Management employees who manage these lands under very difficult circumstances. In my opinion the real threat to "wilderness ideals" is the drastic increase in visitation resulting from the designation of the area as a national monument.

ERNEST J. EBERHARD
Sandy, Utah

The irony of the Escalante political trauma is that the good guys and the baddies (depending on one's audience) love the same thing, but both camps have been told and convinced that they don't like each other. That is changing in a state where tourism and recreation are now approaching a four-billion-dollar annual take, and for counties like Kane and Garfield, motels, food services, and gas stations are the only viable economic games in town.

STU CARLSON
Park City, Utah

I greatly cherish the spectacular scenery and solitude experienced while traveling backcountry roads in the new Grand Staircase–Escalante National Monument. I was dismayed, however, by the comment on page 103 by Ken Rait, formerly of the Southern Utah Wilderness Alliance, "If you tell anyone how to get here, I will have to kill you." This attitude is certainly a key to much of the controversy and dissension over how much land should



be designated "wilderness" in the region. A majority of the public believes that we can allow responsible access and still protect the environment, as we have for decades.

ROBERT L. NORTON
Edgewood, New Mexico

I was surprised that your article didn't mention the Society's contribution to the exploration of the area. In 1948 National Geographic organized the first motorized expedition into that then least known part of Utah and Arizona. Members of the expedition were responsible for giving names to such places as Kodachrome Basin and Grosvenor Arch. The description of the trip can be found in the September 1949 magazine.

ADAM LECHOWSKI
Santa Rosa, California

Listening to Humpbacks

Living on the shore of Frederick Sound, I have had the great fortune to hear humpbacks singing above the water. One October they were singing so loud that my neighbors and I heard them from inside our houses. For several nights in a row they sang a full spectrum from bass to alto. The experience of hearing such an opera is breathtaking. I could feel the deepest voices vibrate in my chest while the humpbacks splashed and played under a shimmering moon. How good it is to read that the population of these magnificent creatures is increasing.

DIETER KLOSE
Petersburg, Alaska

On page 126 the author says that "underwater [humpbacks] can blast out at 170 decibels—louder than a jet's roar." Because of the different properties of air and water it is not meaningful to compare sound levels in air with sound levels in water. By applying a standard 26-decibel correction factor to the underwater sound level quoted in the article, the whale would blast out at 144 decibels—still intense but significantly lower.

ELIZABETH BECKER
Santa Barbara, California

According to the American Academy of Otolaryngology, jets in the air register 140 decibels, so the underwater blast of a humpback would still be louder.

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Concerts & Lectures at the Met

One Hundred Passenger Years

John Maxtone-Graham

Join historian John Maxtone-Graham for his retrospective of a remarkable shipboard century. By the 1950s, the world's most luxurious vessels succumbed to aircraft, the tropics beckoned, and indolent cruises began. Clothing, customs, profiles, and interiors underwent drastic social, artistic, and architectural changes as, astonishingly, even vaster hulls proliferated.

February 2 Immigrants and Industrialists aboard *Mauretania, Titanic, Berengaria,* and *Bremen*

February 9 The Fabled Atlantic Crossings of *Normandie,* the Two *Queens,* and *United States*

February 16 For Caribbean Cruising, *Norway* and Megaships *Grand Princess* and *Voyager of the Seas*

3 Wednesdays at 6:00: $45
Single Tickets: $20

Art and Literature
One Thousand Years

Janetta Rebold Benton
Robert DiYanni

In celebration of the millennium, these four conversations examine some of the cultural highlights of the last 1,000 years. While looking at art and architecture and reading literature, Professors Benton and DiYanni trace the trends that tie diverse arts together. These lectures are linked to their recent book, *Arts and Culture,* published by Prentice Hall.

January 5 Medieval to Renaissance: Chartres and Dante to Michelangelo and Shakespeare

January 12 Baroque to Neoclassical: Versailles and Milton to David and Pope

January 19 Romantic to Realist: Turner and Wordsworth to Cézanne and Flaubert

January 26 Picasso, Wright, Eliot, and Woolf to Predictions for the New Millennium

4 Wednesdays at 6:00: $65
Single Tickets: $20

Ancient Greek Literature in the Present Day

Three scholars discuss literary works that complement the masterpieces of the sixth through fourth centuries B.C. that are exhibited in The Met's New Greek Galleries.

Robert Fagles
January 21 An Evening's Odyssey with Homer

Rachel Hadas
January 28 Mirrors in Euripides

Gregory Nagy
February 4 Sappho and Pindar

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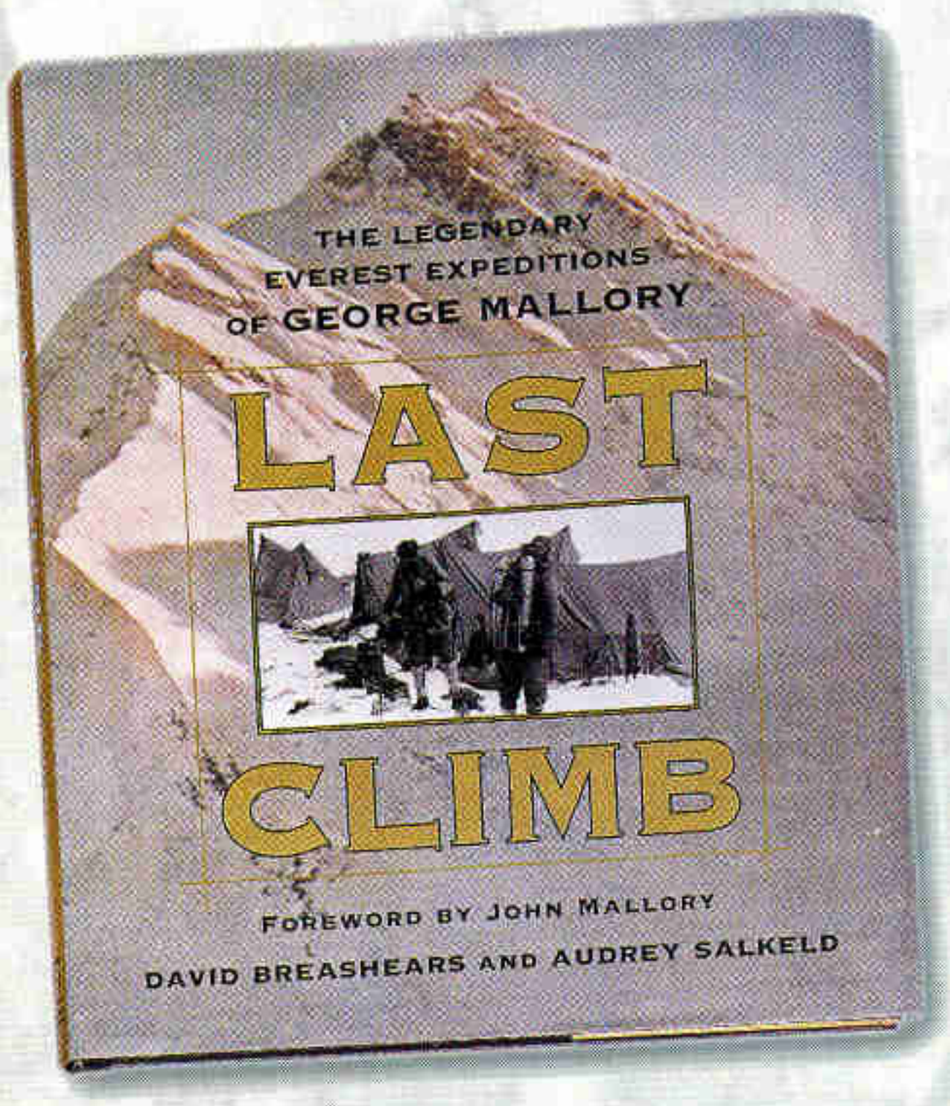
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DINOSAUR FEVER

■ EXPLORER, SUNDAY, NOVEMBER 14

Nobody does it bigger than paleontologist Paul Sereno, whose groundbreaking work in the Sahara led to the discovery of perhaps the largest land predator yet found: the 90-million-year-old meat-eater known as *Carcharodontosaurus*—"shark-toothed reptile" (above). Now he is following in the footprints of an even larger creature. It is a new entry in the sauropod group, whose name Sereno will announce on November 14 on EXPLORER. Existing only in Africa, the 40,000-pound leaf-eater had a brain about the size of a baseball and came from a lineage that endured for 40 million years. Says Sereno, "This animal makes you wonder how evolution could have stood still for so long. It was a real survivor."

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MARK THIESSEN, NGS



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Prilosec®* *(omeprazole)*

Delayed-Release Capsules

BRIEF SUMMARY. Before prescribing, please consult full Prescribing Information.

CLINICAL PHARMACOLOGY, Pharmacokinetics and Metabolism: Omeprazole In pharmacokinetic studies of single 20 mg omeprazole doses, an increase in AUC of approximately four-fold was noted in Asian subjects compared to Caucasians. Dose adjustment, particularly where maintenance of healing of erosive esophagitis is indicated, for the hepatically impaired and Asian subjects should be considered.

INDICATIONS AND USAGE, Duodenal Ulcer: PRILOSEC is indicated for short-term treatment of active duodenal ulcer. Most patients heal within 4 weeks. Some patients may require an additional 4 weeks of therapy. PRILOSEC, in combination with clarithromycin and amoxicillin, is indicated for treatment of patients with *H. pylori* infection and duodenal ulcer disease (active or up to 1-year history) to eradicate *H. pylori*. PRILOSEC, in combination with clarithromycin, is also indicated for treatment of patients with *H. pylori* infection and duodenal ulcer disease to eradicate *H. pylori*. Eradication of *H. pylori* has been shown to reduce the risk of duodenal ulcer recurrence. Among patients who fail therapy, PRILOSEC with clarithromycin is more likely to be associated with the development of clarithromycin resistance as compared with triple therapy. In patients who fail therapy, susceptibility testing should be done. If resistance to clarithromycin is demonstrated or susceptibility testing is not possible, alternative antimicrobial therapy should be instituted. (See the clarithromycin package insert, MICROBIOLOGY section.) **Gastric Ulcer:** PRILOSEC is indicated for short-term treatment (4-8 weeks) of active benign gastric ulcer. **Treatment of Gastroesophageal Reflux Disease (GERD):** *Symptomatic GERD*— PRILOSEC is indicated for the treatment of heartburn and other symptoms associated with GERD. *Erosive Esophagitis*— PRILOSEC is indicated for the short-term treatment (4-8 weeks) of erosive esophagitis which has been diagnosed by endoscopy. The efficacy of PRILOSEC used for longer than 8 weeks in these patients has not been established. In the rare instance of a patient not responding to 8 weeks of treatment, it may be helpful to give up to an additional 4 weeks of treatment. If there is recurrence of erosive esophagitis or GERD symptoms (e.g., heartburn), additional 4-8 week courses of omeprazole may be considered. **Maintenance of Healing of Erosive Esophagitis:** PRILOSEC is indicated to maintain healing of erosive esophagitis. Controlled studies do not extend beyond 12 months. **Pathological Hypersecretory Conditions:** PRILOSEC is indicated for the long-term treatment of pathological hypersecretory conditions (e.g., Zollinger-Ellison syndrome, multiple endocrine adenomas and systemic mastocytosis).

CONTRAINDICATIONS, Omeprazole: PRILOSEC Delayed-Release Capsules are contraindicated in patients with known hypersensitivity to any component of the formulation. **Clarithromycin:** Clarithromycin is contraindicated in patients with a known hypersensitivity to any macrolide antibiotic. Concomitant administration of clarithromycin with cisapride, pimozide, or terfenadine is contraindicated. There have been post-marketing reports of drug interactions when clarithromycin and/or erythromycin are co-administered with cisapride, pimozide, or terfenadine resulting in cardiac arrhythmias (QT prolongation, ventricular tachycardia, ventricular fibrillation, and torsades de pointes) most likely due to inhibition of hepatic metabolism of these drugs by erythromycin and clarithromycin. Fatalities have been reported. (Please refer to full prescribing information for clarithromycin before prescribing.) **Amoxicillin:** Amoxicillin is contraindicated in patients with a history of allergic reaction to any of the penicillins. (Please refer to full prescribing information for amoxicillin before prescribing.)

WARNINGS, Clarithromycin: CLARITHROMYCIN SHOULD NOT BE USED IN PREGNANT WOMEN EXCEPT IN CLINICAL CIRCUMSTANCES WHERE NO ALTERNATIVE THERAPY IS APPROPRIATE. IF PREGNANCY OCCURS WHILE TAKING CLARITHROMYCIN, THE PATIENT SHOULD BE APPRISED OF THE POTENTIAL HAZARD TO THE FETUS. (See WARNINGS in prescribing information for clarithromycin.) Amoxicillin: SERIOUS AND OCCASIONALLY FATAL HYPERSENSITIVITY (anaphylactic) REACTIONS HAVE BEEN REPORTED IN PATIENTS ON PENICILLIN THERAPY. THESE REACTIONS ARE MORE LIKELY TO OCCUR IN INDIVIDUALS WITH A HISTORY OF PENICILLIN HYPERSENSITIVITY AND/OR A HISTORY OF SENSITIVITY TO MULTIPLE ALLERGENS. BEFORE INITIATING THERAPY WITH AMOXICILLIN, CAREFUL INQUIRY SHOULD BE MADE CONCERNING PREVIOUS HYPERSENSITIVITY REACTIONS TO PENICILLINS, CEPHALOSPORINS OR OTHER ALLERGENS. IF AN ALLERGIC REACTION OCCURS, AMOXICILLIN SHOULD BE DISCONTINUED AND APPROPRIATE THERAPY INSTITUTED. **SERIOUS ANAPHYLACTIC REACTIONS REQUIRE IMMEDIATE EMERGENCY TREATMENT WITH EPINEPHRINE. OXYGEN, INTRAVENOUS STEROIDS AND AIRWAY MANAGEMENT, INCLUDING INTUBATION, SHOULD ALSO BE ADMINISTERED AS INDICATED.** (See WARNINGS in prescribing information for amoxicillin.) **Antimicrobials: Pseudomembranous colitis has been reported with nearly all antibacterial agents and may range in severity from mild to life-threatening. Therefore, it is important to consider this diagnosis in patients who present with diarrhea subsequent to the administration of antibacterial agents.** (See WARNINGS in prescribing information for clarithromycin and amoxicillin.)

PRECAUTIONS, General: Symptomatic response to therapy with omeprazole does not preclude the presence of gastric malignancy. Atrophic gastritis has been noted occasionally in gastric corpus biopsies from patients treated long-term with omeprazole. **Information for Patients:** PRILOSEC Delayed-Release Capsules should be taken before eating. Patients should be cautioned that the PRILOSEC Delayed-Release Capsule should not be opened, chewed or crushed, and should be swallowed whole. **Drug Interactions:** *Other*— Omeprazole can prolong the elimination of diazepam, warfarin and phenytoin, drugs that are metabolized by oxidation in the liver. Although in normal subjects no interaction with theophylline or propranolol was found, there have been clinical reports of interaction with other drugs metabolized via the cytochrome P-450 system (e.g., cyclosporine, disulfiram, benzodiazepines). Patients should be monitored to determine if it is necessary to adjust the dosage of these drugs when taken concomitantly with PRILOSEC. Because of its profound and long lasting inhibition of gastric acid secretion, it is theoretically possible that omeprazole may interfere with absorption of drugs where gastric pH is an important determinant of their bioavailability (e.g., ketoconazole, ampicillin esters, and iron salts). In the clinical trials, antacids were used concomitantly with the administration of PRILOSEC. *Combination Therapy with Clarithromycin*— Co-administration of omeprazole and clarithromycin have resulted in increases in plasma levels of omeprazole, clarithromycin, and 14-hydroxy-clarithromycin. (See CLINICAL PHARMACOLOGY, Pharmacokinetics: Combination Therapy with Antimicrobials in full Prescribing Information.) Concomitant administration of clarithromycin with cisapride, pimozide, or terfenadine is contraindicated. There have been reports of an interaction between erythromycin and astemizole resulting in QT prolongation and torsades de pointes. Concomitant administration of erythromycin and astemizole is contraindicated. Because clarithromycin is also metabolized by cytochrome P-450, concomitant administration of clarithromycin with astemizole is not recommended. (See also CONTRAINDICATIONS, Clarithromycin, above. Please refer to full prescribing information for clarithromycin before prescribing.) **Carcinogenesis, Mutagenesis, Impairment of Fertility:** In two 24-month carcinogenicity studies in rats, omeprazole at daily doses of 1.7, 3.4, 13.8, 44.0 and 140.8 mg/kg/day (approximately 4 to 352 times the human dose, based on a patient weight of 50 kg and a human dose of 20 mg) produced gastric ECL cell carcinoids in a dose-related manner in both male and female rats; the incidence of this effect was markedly higher in female rats, which had higher blood levels of omeprazole. Gastric carcinoids seldom occur in the untreated rat. In addition, ECL cell hyperplasia was present in all treated groups of both sexes. In one of these studies, female rats were treated with 13.8 mg/kg/day omeprazole (approximately 35 times the human dose) for 1 year, then followed for an additional year without the drug. No carcinoids were seen in these rats. An increased incidence of treatment-related ECL cell hyperplasia was observed at the end of 1 year (94% treated vs 10% controls). By the second year the difference between treated and control rats was much smaller (46% vs 26%) but still showed more hyperplasia in the treated group. An unusual primary malignant tumor in the stomach was seen in one rat (2%). No similar tumor was seen in male or female rats treated for 2 years. For this strain of rat no similar tumor has been noted historically, but a finding involving only one tumor is difficult to interpret. A 78-week mouse carcinogenicity study of omeprazole did not show increased tumor occurrence, but the study was not conclusive. Omeprazole was not mutagenic in an *in vitro* Ames *Salmonella typhimurium* assay, an *in vitro* mouse lymphoma cell assay and an *in vivo* rat liver DNA damage assay. A mouse micronucleus test at 625 and 6250 times the human dose gave a borderline result, as did an *in vivo* bone marrow chromosome aberration test. A second mouse micronucleus study at 2000 times the human dose, but with different (suboptimal) sampling times, was negative. **Pregnancy: Omeprazole:** *Pregnancy Category C*— In rabbits, omeprazole in a dose range of 6.9 to 69.1 mg/kg/day (approximately 17 to 172 times the human dose) produced dose-related increases in embryo-lethality, fetal resorptions and pregnancy disruptions. In rats, dose-related embryo/fetal toxicity and postnatal developmental toxicity were observed in offspring resulting from parents treated with omeprazole 13.8 to 138.0 mg/kg/day (approximately 35 to 345 times the human dose). There are no adequate or well-controlled studies in pregnant women. Sporadic reports have been received of congenital abnormalities occurring in infants born to women who have received omeprazole during pregnancy. Omeprazole should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus. **Clarithromycin:** *Pregnancy Category C*— See WARNINGS (above) and full prescribing information for clarithromycin before using in pregnant women. **Nursing Mothers:** It is not known whether omeprazole is excreted in human milk. In rats, omeprazole administration during late gestation and lactation at doses of 13.8 to 138 mg/kg/day (35 to 345 times the human dose) resulted in decreased weight gain in pups. Because many drugs are excreted in human milk, because of the potential for serious adverse reactions in nursing infants from omeprazole, and because of the potential for tumorigenicity shown for omeprazole in rat carcinogenicity studies, a decision should be made whether to discontinue nursing or discontinue the drug, taking into account the importance of the drug to the mother. **Pediatric Use:** Safety and effectiveness in pediatric patients have not been established.

ADVERSE REACTIONS: In the U.S. clinical trial population of 465 patients (including duodenal ulcer, Zollinger-Ellison syndrome and resistant ulcer patients), the following adverse experiences were reported to occur in 1% or more of patients on therapy with PRILOSEC® (omeprazole). Numbers in parentheses indicate percentages of the adverse experiences considered by investigators as possibly, probably, or definitely related to the drug.

	Omeprazole (n=465)	Placebo (n=64)	Ranitidine (n=195)
Headache	6.9 (2.4)	6.3	7.7 (2.6)
Diarrhea	3.0 (1.9)	3.1 (1.6)	2.1 (0.5)
Abdominal Pain	2.4 (0.4)	3.1	2.1
Nausea	2.2 (0.9)	3.1	4.1 (0.5)
URI	1.9	1.6	2.6
Dizziness	1.5 (0.6)	0.0	2.6 (1.0)
Vomiting	1.5 (0.4)	4.7	1.5 (0.5)
Rash	1.5 (1.1)	0.0	0.0
Constipation	1.1 (0.9)	0.0	0.0
Cough	1.1	0.0	1.5
Asthenia	1.1 (0.2)	1.6 (1.6)	1.5 (1.0)
Back Pain	1.1	0.0	0.5

The following adverse reactions which occurred in 1% or more of omeprazole-treated patients have been reported in international double-blind, and open-label, clinical trials in which 2,631 patients and subjects received omeprazole.

Incidence of Adverse Experiences ≥ 1% Causal Relationship not Assessed

		Omeprazole (n=2,631)	Placebo (n=120)
Body as a Whole, site unspecified	Abdominal pain	5.2	3.3
	Asthenia	1.3	0.8
Digestive System	Constipation	1.5	0.8
	Diarrhea	3.7	2.5
	Flatulence	2.7	5.8
	Nausea	4.0	6.7
	Vomiting	3.2	10.0
	Acid regurgitation	1.9	3.3
Nervous System/Psychiatric	Headache	2.9	2.5

Additional adverse experiences occurring in <1% of patients or subjects in domestic and/or international trials, or occurring since the drug was marketed, are shown below within each body system. In many instances, the relationship to PRILOSEC was unclear. *Body As a Whole:* Allergic reactions including, rarely, anaphylaxis (see also *Skin* below), fever, pain, fatigue, malaise, abdominal swelling. *Cardiovascular:* Chest pain or angina, tachycardia, bradycardia, palpitation, elevated blood pressure, peripheral edema. *Gastrointestinal:* Pancreatitis (some fatal), anorexia, irritable colon, flatulence, fecal discoloration, esophageal candidiasis, mucosal atrophy of the tongue, dry mouth. During treatment with omeprazole, gastric fundic gland polyps have been noted rarely. These polyps are benign and appear to be reversible when treatment is discontinued. Gastro-duodenal carcinoids have been reported in patients with ZE syndrome on long-term treatment with PRILOSEC. This finding is believed to be a manifestation of the underlying condition, which is known to be associated with such tumors. *Hepatic:* Mild and, rarely, marked elevations of liver function tests [ALT (SGPT), AST (SGOT), γ-glutamyl transpeptidase, alkaline phosphatase, and bilirubin (jaundice)]. In rare instances, overt liver disease has occurred, including hepatocellular, cholestatic, or mixed hepatitis, liver necrosis (some fatal), hepatic failure (some fatal), and hepatic encephalopathy. *Metabolic/Nutritional:* Hyponatremia, hypoglycemia, weight gain. *Musculoskeletal:* Muscle cramps, myalgia, muscle weakness, joint pain, leg pain. *Nervous System/Psychiatric:* Psychic disturbances including depression, aggression, hallucinations, confusion, insomnia, nervousness, tremors, apathy, somnolence, anxiety, dream abnormalities; vertigo; paresthesia; hemifacial dysesthesia. *Respiratory:* Epistaxis, pharyngeal pain. *Skin:* Rash and, rarely, cases of severe generalized skin reactions including toxic epidermal necrolysis (TEN; some fatal), Stevens-Johnson syndrome, and erythema multiforme (some severe); purpura and/or petechiae (some with rechallenge); skin inflammation, urticaria, angioedema, pruritus, alopecia, dry skin, hyperhidrosis. *Special Senses:* Tinnitus, taste perversion. *Urogenital:* Interstitial nephritis (some with positive rechallenge), urinary tract infection, microscopic pyuria, urinary frequency, elevated serum creatinine, proteinuria, hematuria, glycosuria, testicular pain, gynecomastia. *Hematologic:* Rare instances of pancytopenia, agranulocytosis (some fatal), thrombocytopenia, neutropenia, anemia, leucocytosis, and hemolytic anemia have been reported. **Combination Therapy for *H. pylori* Eradication:** dual therapy with PRILOSEC and clarithromycin or triple therapy with PRILOSEC, clarithromycin, and amoxicillin. Adverse experiences that have occurred have been limited to those that have been previously reported with omeprazole, clarithromycin, or amoxicillin. *Triple Therapy (PRILOSEC/clarithromycin/amoxicillin)*— The most frequent adverse experiences observed in clinical trials using combination therapy with PRILOSEC, clarithromycin, and amoxicillin (n = 274) were diarrhea (14%), taste perversion (10%), and headache (7%). None of these occurred at a higher frequency than that reported by patients taking the antimicrobial drugs alone. *Dual Therapy (PRILOSEC/clarithromycin)*— Adverse experiences observed in controlled clinical trials using combination therapy with PRILOSEC and clarithromycin (n = 346) which differed from those previously described for omeprazole alone were: Taste perversion (15%), tongue discoloration (2%), rhinitis (2%), pharyngitis (1%) and flu syndrome (1%). For more information on clarithromycin or amoxicillin, refer to the respective package inserts, ADVERSE REACTIONS sections.

OVERDOSAGE: Rare reports have been received of overdosage with omeprazole. Doses ranged from 320 mg to 900 mg (16-45 times the usual recommended clinical dose). Manifestations were variable, but included confusion, drowsiness, blurred vision, tachycardia, nausea, diaphoresis, flushing, headache, and dry mouth. Symptoms were transient, and no serious clinical outcome has been reported. No specific antidote for omeprazole overdosage is known. Omeprazole is extensively protein bound and is, therefore, not readily dialyzable. In the event of overdosage, treatment should be symptomatic and supportive.

DOSAGE AND ADMINISTRATION, Short-Term Treatment of Active Duodenal Ulcer: The recommended adult oral dose of PRILOSEC is 20 mg once daily. Most patients heal within 4 weeks. Some patients may require an additional 4 weeks of therapy. (See INDICATIONS AND USAGE.) ***H. pylori* Eradication for the Reduction of the Risk of Duodenal Ulcer Recurrence:** *Triple Therapy (PRILOSEC/clarithromycin/amoxicillin)*— The recommended adult oral regimen is PRILOSEC 20 mg plus clarithromycin 500 mg plus amoxicillin 1000 mg each given twice daily for 10 days. In patients with an ulcer present at the time of initiation of therapy, an additional 18 days of PRILOSEC 20 mg once daily is recommended for ulcer healing and symptom relief. *Dual Therapy (PRILOSEC/clarithromycin)*— The recommended adult oral regimen is PRILOSEC 40 mg once daily plus clarithromycin 500 mg t.i.d. for 14 days. In patients with an ulcer present at the time of initiation of therapy, an additional 14 days of PRILOSEC 20 mg once daily is recommended for ulcer healing and symptom relief. Please refer to clarithromycin full prescribing information for CONTRAINDICATIONS and WARNING, and for information regarding dosing in elderly and renally impaired patients (PRECAUTIONS: General, PRECAUTIONS: Geriatric Use and PRECAUTIONS: Drug Interactions). Please refer to amoxicillin full prescribing information for CONTRAINDICATIONS and WARNINGS. **Gastric Ulcer:** The recommended adult oral dose is 40 mg once a day for 4 to 8 weeks. (See INDICATIONS AND USAGE, Gastric Ulcer.) **Gastroesophageal Reflux Disease (GERD):** The recommended adult oral dose for the treatment of patients with symptomatic GERD and no esophageal lesions is 20 mg daily for up to 4 weeks. The recommended adult oral dose for the treatment of patients with erosive esophagitis and accompanying symptoms due to GERD is 20 mg daily for 4 to 8 weeks. (See INDICATIONS AND USAGE.) **Maintenance of Healing of Erosive Esophagitis:** The recommended adult oral dose is 20 mg daily. **Pathological Hypersecretory Conditions:** The dosage of PRILOSEC in patients with pathological hypersecretory conditions varies with the individual patient. The recommended adult oral starting dose is 60 mg once a day. Doses should be adjusted to individual patient needs and should continue for as long as clinically indicated. Doses up to 120 mg t.i.d. have been administered. Daily dosages of greater than 80 mg should be administered in divided doses. No dosage adjustment is necessary for patients with renal impairment, hepatic dysfunction or for the elderly.

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NOTE: This summary provides important information about PRILOSEC. If you would like more information, ask your doctor or pharmacist to let you read the professional labeling and then discuss it with them.

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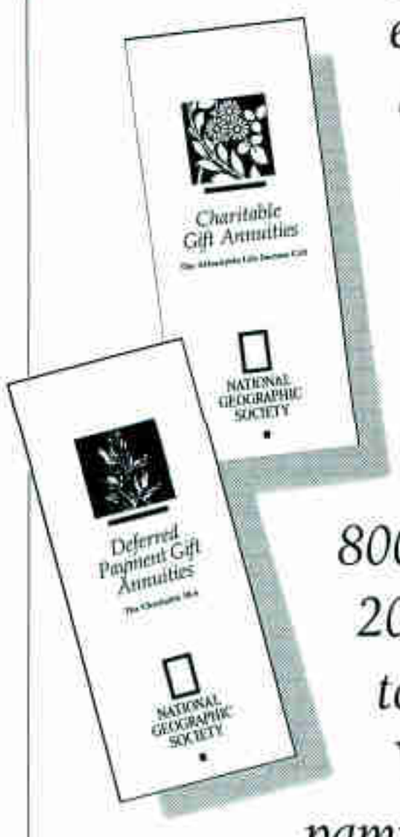
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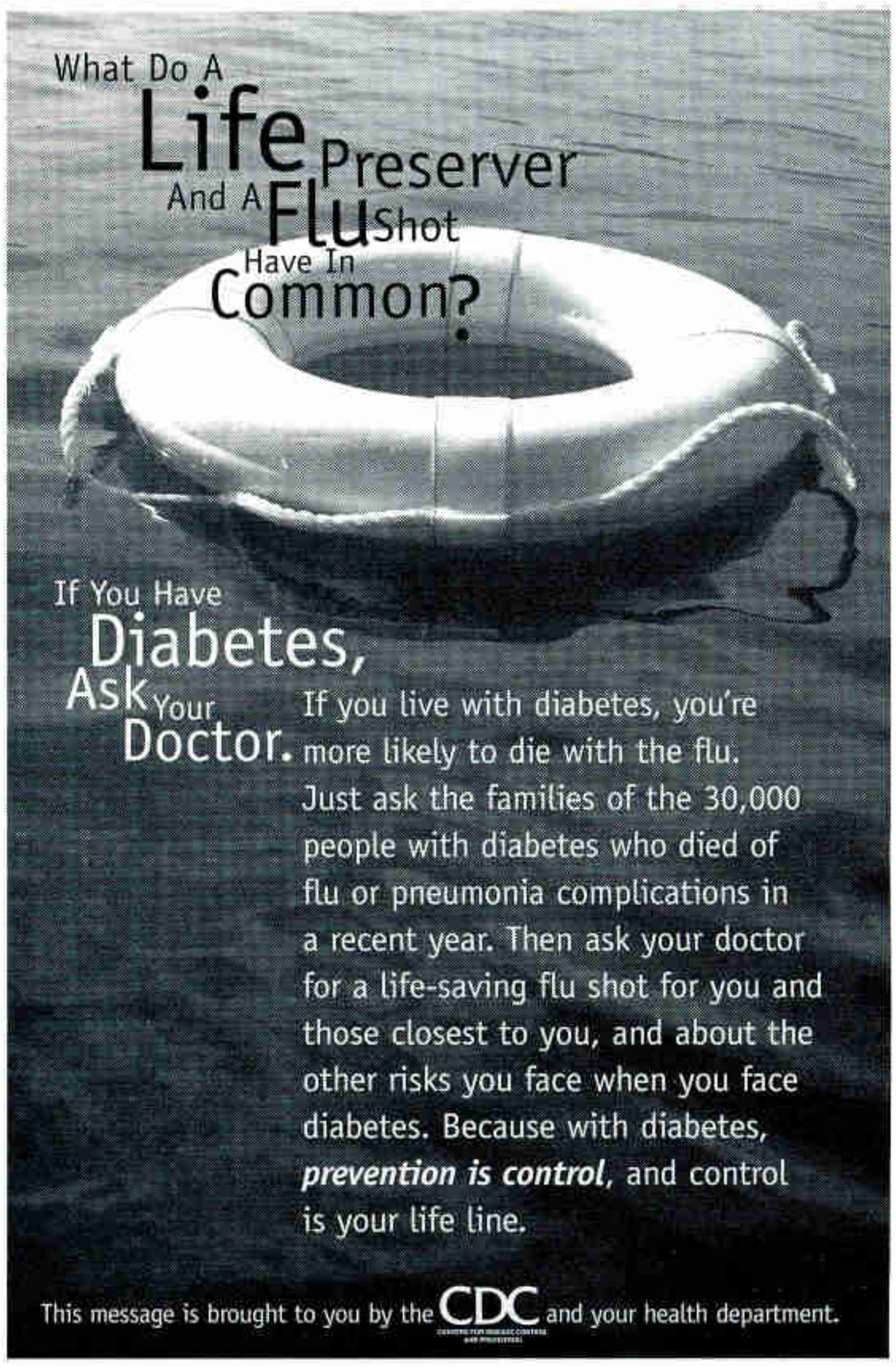
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Earth Almanac



GALEN ROWELL, MOUNTAIN LIGHT

Mountain Lion's Comeback Deals Bighorn Sheep a Setback

Bighorn sheep clinging to crags in California's Sierra Nevada have become disturbingly rare. Around 1850 there were at least a thousand, says the University of California's John Wehausen, who has studied the Sierra Nevada subspecies for 25 years. "We're down to about a hundred adults," he says. Last April the U.S. Fish and Wildlife Service assigned the sheep emergency endangered status. Mountain lions—protected by a hunting ban since 1972—have increased and are killing the sheep. In addition, bighorns usually leave the high country in winter to forage. But fear of lions now prevents them from doing so, and many sheep starve. Five groups have dwindled to fewer than 25 animals; a captive-breeding program is planned.

No Stopping 40,000 Salamanders

That's roughly how many marbled salamanders live around a South Carolina pond called Ginger's Bay. Every fall David Scott of the Savannah River Ecology Laboratory collects thousands in his traps (right) to mark them and then attempts to recapture the amphibians the next year. Many of the salamanders migrate to the pond from nearby woodlands to mate. Their eggs hatch with the winter rains.



DAVID SCOTT, SREL



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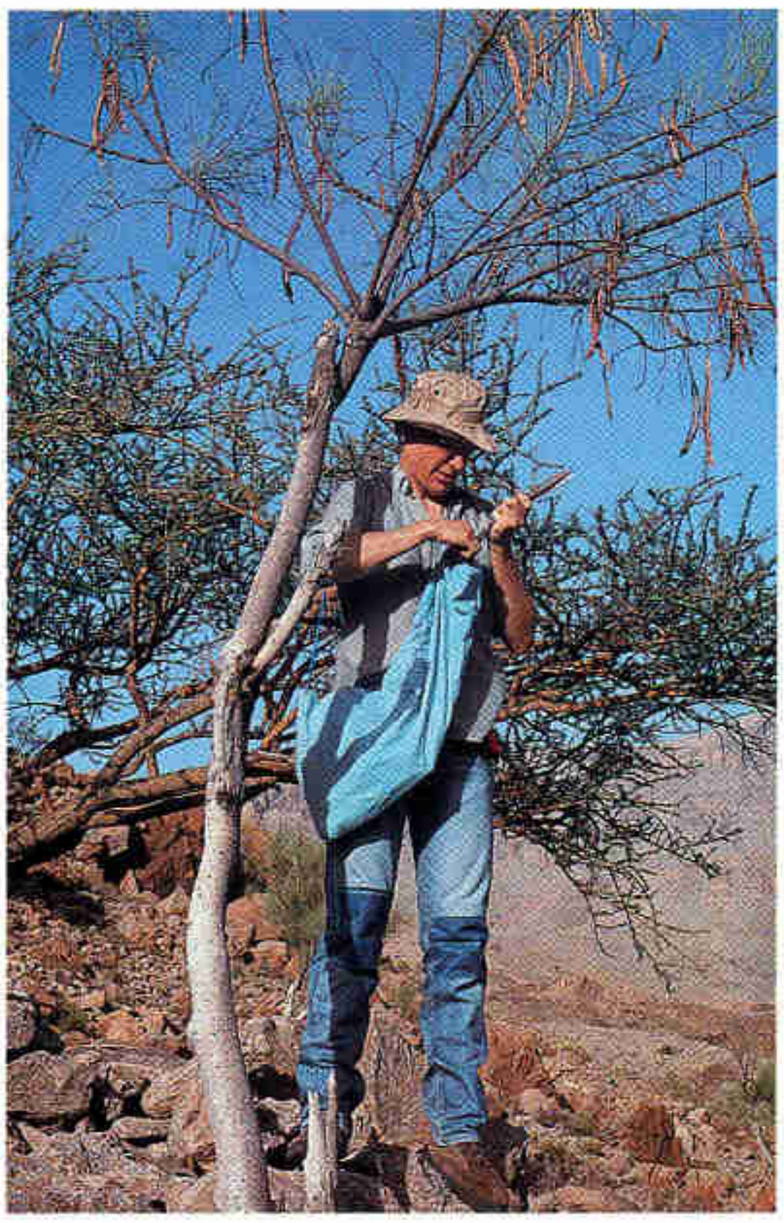
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Strange Plants Abound in Tropical Dry Forests

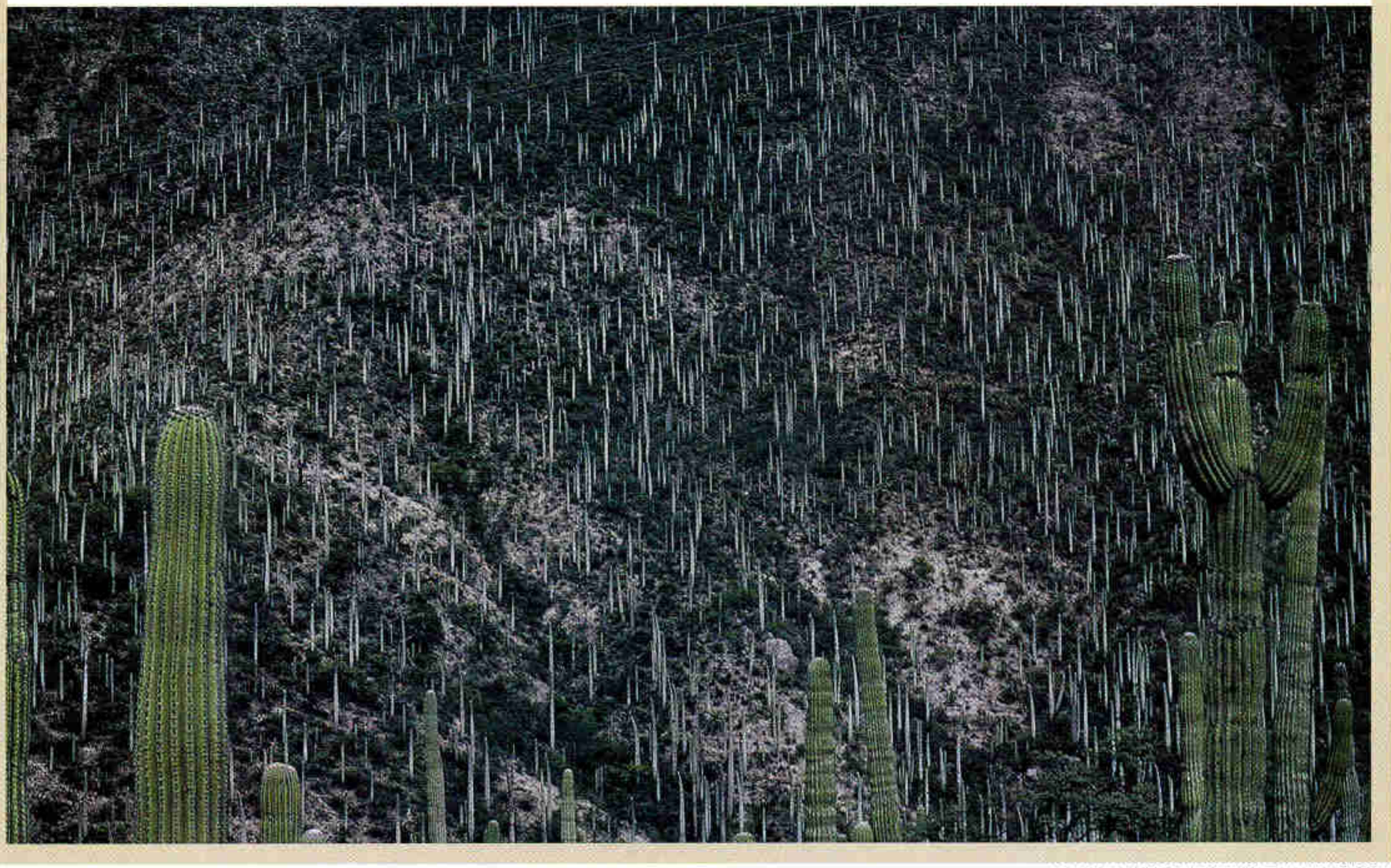
Rain forests are famous for their diversity of species. But Mark Olson of the Missouri Botanical Garden studies other little-known habitats that may support the most forms of plant life—tropical dry forests. These climatic hybrids are tropical habitats that are dry for part of each year.



"Dry-forest plants continually amaze and shock me with their unbelievable colors, forms, and textures," says Olson, here in Oman collecting seeds from a *Moringa peregrina* tree (right). He is using DNA from leaf samples to compare all 13 *Moringa* species, which range from huge bottle trees to a tuberous herb.



He found a purple fungus (left) among baobabs and persimmon trees in Madagascar's Mikea Forest. In Mexico cactuses called column of Trajan march up a hillside, with bright green tetecho cactuses in the foreground. Little rain falls in this type of dry forest, but it falls predictably.



BARBARA ALONGI (TOP RIGHT); MARK OLSON



You can't prevent a flood, but you can prevent a disaster.

Since homeowner's insurance doesn't cover floods, you may be in for an expensive surprise. It's a fact that may come as news to many people, and often too late: Only flood insurance covers floods. Available through your insurance agent, it's the best way to protect your home and family when flood damage occurs. And compared to going into debt or having to qualify for disaster relief, the cost of flood insurance is a drop in the bucket.

Think you can't be flooded? Think again.

Even if you don't live near water or live on a hill and believe you're safe from floods, just listen to the news. Experts report that weather patterns are changing fast, and so are your chances of being flooded. In fact, last year, two out of three federally declared disasters were flood related. And what's more, 25% of all flood claims came from areas no one considered high risk.

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Warning Colors or Camouflage? One Grasshopper Uses Both

"I am poisonous!" announce vivid hues in some insects and animals. But how did such coloration evolve? Clues come from a grasshopper studied by Gregory Sword of the University of Texas. Juveniles feed only on skunkbush, which makes them toxic. Whether they advertise depends on their numbers. When alone, the young stay green, at right, to blend into their habitat and avoid predators like birds. But when they meet and form groups, they all change to black-and-yellow, left, a warning. An inexperienced bird that snatches one and spits it out learns the danger signal faster if many grasshoppers flaunt it.



SCHISTOCERCA EMARGINATA, GREGORY SWORD



A. J. LYNAM, WILDLIFE CONSERVATION SOCIETY

Researchers Use Tiger Self-portraits for a Far-flung Survey

Only a few thousand wild tigers survive worldwide (GEOGRAPHIC, December 1997). To learn how the big cats are faring in Thailand, Tony Lynam and a team from the Wildlife Conservation Society and Thailand's forestry department borrowed a technique from wildlife photography: setting "camera traps" in which a tiger trips an infrared beam and takes its own picture (above). "We've recorded only seven tigers from 150 square miles of forests surveyed," Lynam reports. Some photos exposed armed men—probably poachers—on tiger trails. Similar surveys are under way in Cambodia, Myanmar (Burma), and Malaysia.

We had to climb over 22 other SUVs to get to the top.

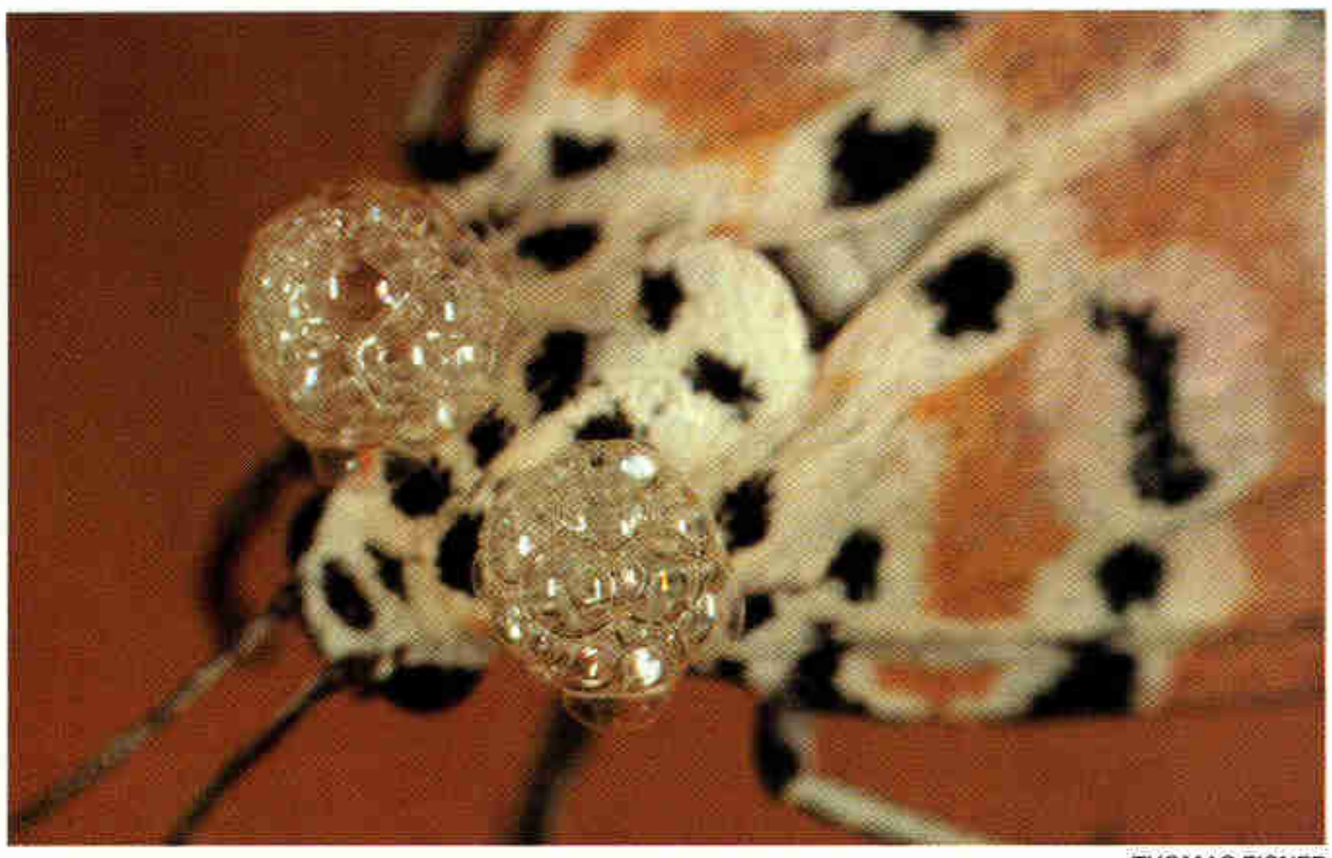
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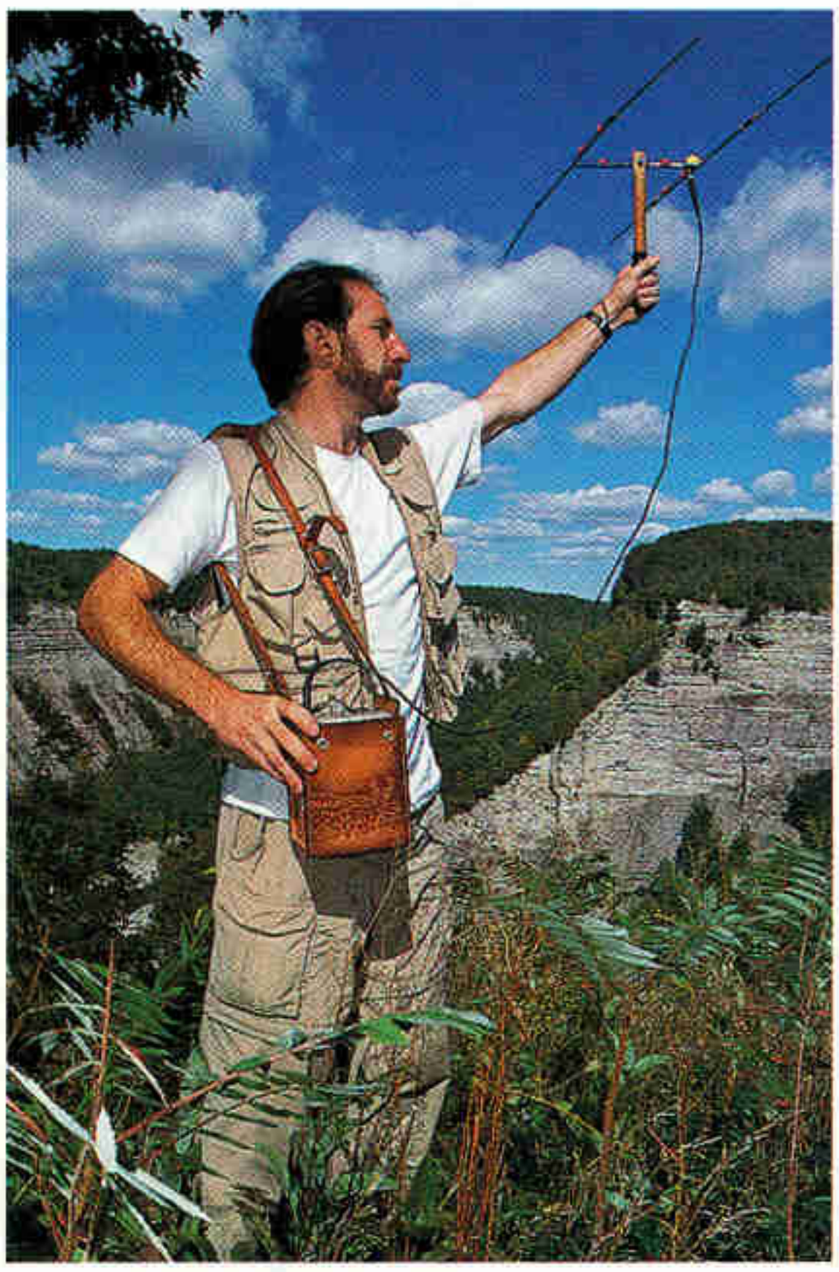
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THOMAS EISNER

Moth's Nuptial Gift: Protection From Predators

When rattlebox moths mate, the male gives it his all, in more ways than one. The packet of sperm he implants in the female also contains a toxic alkaloid that "permeates her body, bubbling out from behind her head when she's disturbed" (left), says Thomas Eisner. He and three Cornell University colleagues made the discovery. The poison wards off predators such as spiders for the female's entire life span—two to three weeks.



A New York Welcome for River Otters



D. ROBERT FRANZ (LEFT); LORRI FRANZ

In a dash for freedom from its holding pen, a river otter joins about 200 others released in central and western New York State since 1995. Otters disappeared here more than a century ago because of habitat loss, unregulated hunting and trapping, and pollution.

The New York River Otter Project has raised nearly $250,000 to reintroduce up to 270 otters transplanted from the Adirondacks and the Catskills—where they are now plentiful—to nine sites farther west, including Letchworth State Park. There, Uruguayan biologist Manuel Spínola (left) has been tracking 28 otters with small transmitters implanted in their abdomens. "Three have died and three have disappeared, but the rest are doing well," he says. Spínola joined the project after studying Neotropical otters in Costa Rica.

Old Computers Reboot Roads

Roadkill on the information highway, obsolete computers are helping to repair real roads in Massachusetts. Plastic parts from computers, televisions, and other electronic equipment are being turned into an asphalt-like filler for potholes. The state also recycles cathode-ray picture tubes and extracts precious metals from circuit boards. But 75,000 tons of old electronics are dumped into Massachusetts landfills each year. With new technologies like high-definition television on the way, officials fear the number could rise to 300,000 tons by 2006 without more recycling.

TEXT BY JOHN L. ELIOT



GUY BILLOUT

Mrs. Charles' story has two happy endings.



One story concerns the common plight of the elderly in a nursing care facility who crave more companionship.

The other is about special needs students: kids whose learning and behavioral problems usually result in too much anger and too little self-esteem.

Faith Charles has a novel approach to both problems: her special needs classes make monthly visits to the California Armenian Home. These visits are especially welcome during the holidays when the students put up decorations, sing carols, make crafts and generally add some holiday cheer to the residents' lives.

Yet, Mrs. Charles' kids may actually receive more than they give. Their self-esteem increases from learning that they can make a real difference in someone else's life. What's more, the activities they share with the residents improve their reading, writing, art and communication skills.

For scripting happy endings to two very different stories, State Farm is pleased to present Mrs. Faith Charles with our Good Neighbor Award® and to donate $5,000 to the Fresno Unified School District Special Education Department in Fresno, California.



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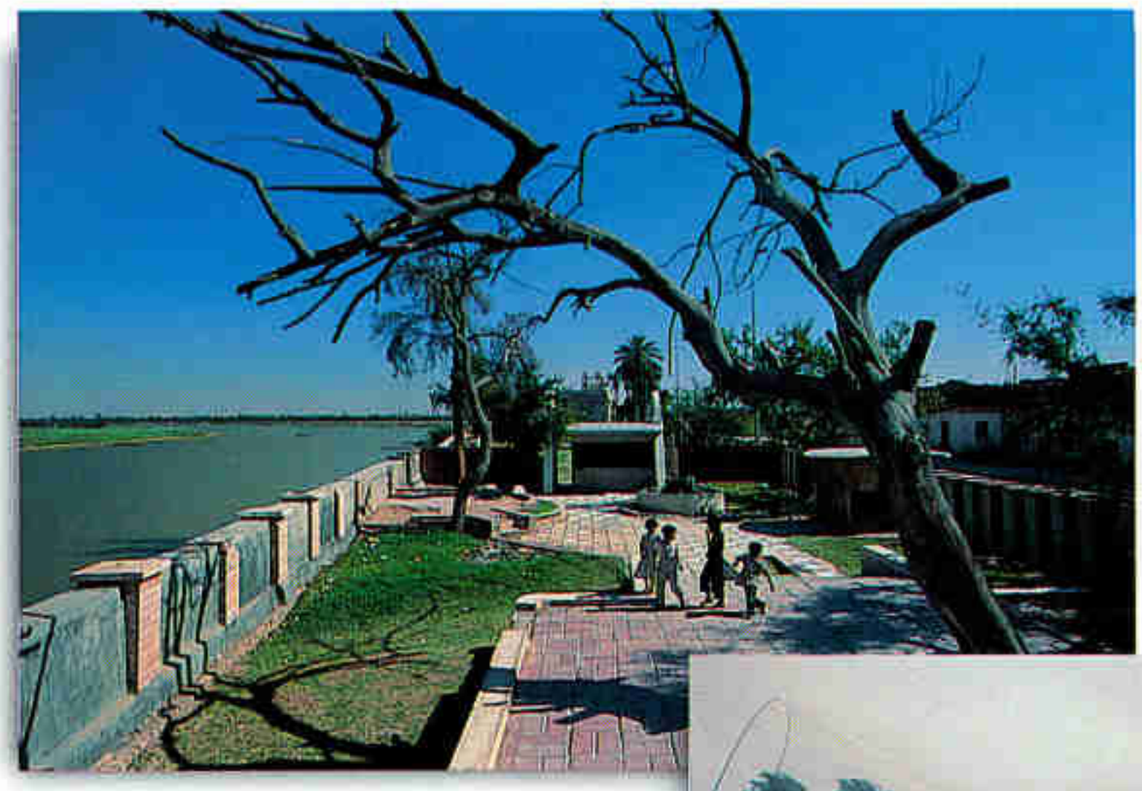


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NATIONAL GEOGRAPHIC

From the Editor

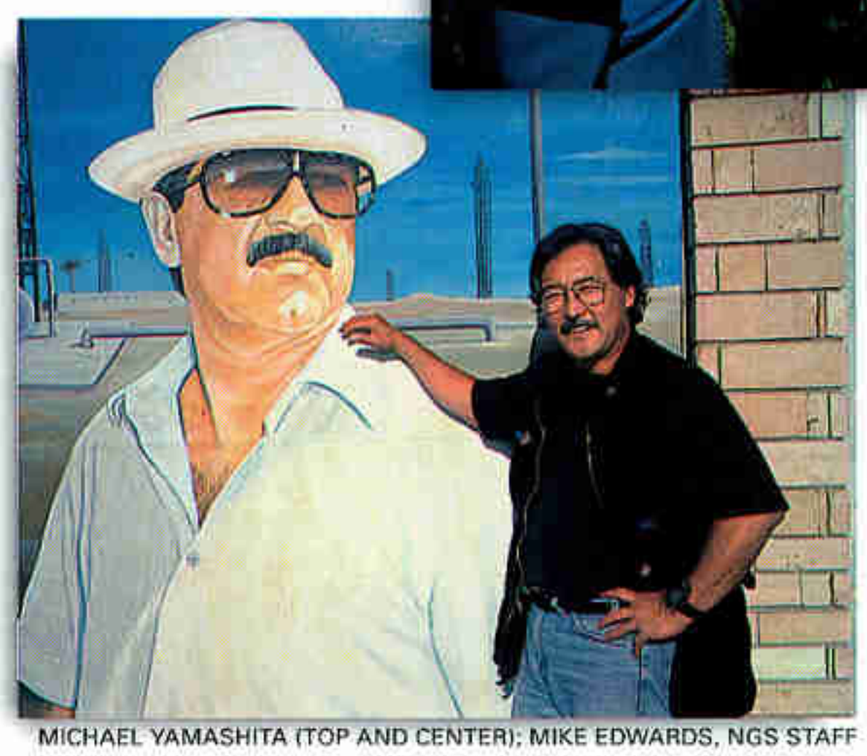




IT'S NOT MUCH to look at now, perhaps, but you should have seen it in the early days—the *really* early days when, according to tradition, this spot at the confluence of the Tigris and Euphrates Rivers in Iraq was the site of the biblical Garden of Eden.

For Assistant Editor Mike Edwards and photographer Michael Yamashita the opportunity for a rare in-depth look at Iraq came out of nowhere. The pair are working on an article about Marco Polo, who wrote about Iraq, and what was supposed to be a short visit became, at the permission of the government, a six-week excursion.

"I don't mean to say we were given carte blanche," says Edwards. "We were closely monitored by two minders. But we did, I believe, come back with a fair story. Certainly Iraq wanted to use us to help get the United Nations embargo lifted, but we also found that a large slice of people—Shiites especially, as well as the Kurds—oppose Saddam Hussein's regime."



MICHAEL YAMASHITA (TOP AND CENTER); MIKE EDWARDS, NGS STAFF

Edwards spent some nervous hours in northern Iraq with a newly trained team of Kurdish sappers (center), who scour the countryside for land mines. And Yamashita, searching out the variety of Saddam images plastered throughout Iraq, found one that resembled a vacation snapshot from Miami Beach.

Now it's back to their epic journey in the great traveler's footsteps.

"It's been 700 years since Marco Polo's odyssey," says Edwards. "What's another year or so?"

Bill Allen

كردوس
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Eyewitness

IRAQ



By MIKE EDWARDS ASSISTANT EDITOR

Photographs by MICHAEL YAMASHITA

PUTTING ON A LOYAL FACE, local militia march in Saddam Hussein's hometown, Tikrit, on the Iraqi ruler's 62nd birthday. Saddam was a no-show, perhaps unsure of his safety in a land torn by ethnic divisions and crippled by war and UN sanctions.

UNDER A SHELTERING SKY patrolled by United States and British planes, Iraqi Kurds relax on Little Zab River in the north. Attempts by U.S. leaders to use the Kurdish zone as a base for unseating Saddam have failed.





VISIONS OF PAST EMPIRES entertain members of Baghdad's upper crust at a Fashion Institute costume show. Although general living standards have crashed, a ruling class thrives, largely on embargo-defying trade.





The world's cheapest gas, at ten cents a gallon, keeps traffic limping along in central Baghdad. With hyperinflation shrinking most professional salaries to less than ten dollars a month, driving a battered red-and-white taxi has become a career move for teachers, engineers, and lawyers.

THE DIRECTOR general of antiquities apologized for yawning. It was 1:30 p.m. in his office near the Iraq Museum in Baghdad. "I got up at three this morning," Muayad Said Damerji explained. "That's when the electricity came on in my neighborhood."

Bombed in the 1991 Persian Gulf war, Iraq's power plants still wheeze along at half their former capacity. So for six hours every day, every Baghdad neighborhood takes a turn without electricity.

"This is a quiet time in archaeology," Damerji said. "We get to do our own projects now." He rose early to write a little more of what surely will be a massive text, the history of architecture in Mesopotamia, the land between the Tigris and Euphrates Rivers, where Western civilization took root.

Photographer MICHAEL YAMASHITA, a GEOGRAPHIC contributor for 20 years, worked with MIKE EDWARDS to cover China's Gold Coast and Hong Kong (March 1997) and explorer Joseph Rock (January 1997).

United Nations sanctions, which include a trade embargo in effect since Iraq's invasion of Kuwait in 1990, keep away the foreign teams—American, German, Italian, French, Japanese—that used to stream into his office to propose excavations in Iraq's fabulous ruins. It is still possible to ascend the ziggurat of Ur and puzzle over the cuneiform scribed there or to stroll in Babylon and imagine the splendor of the hanging gardens. I did those things, but I was all but alone, for tourism is dead, dead.

And to enter the Iraq Museum is like entering a succession of looted tombs. In those halls had been gathered treasures from all the epochs of Iraq; an entire room was devoted to gold ornaments from the eighth-century B.C. Assyrian capital, Nimrud. The display cases are empty now; all the objects that could be moved have been packed and stored.

It is a melancholy refrain, the closing of the museum. The display cases were emptied twice in the 1980s, when bombs and Scud missiles

rained on Baghdad during the eight-year war with Iran. In the gulf war, bombs exploded only 20 yards from the museum. "Face-to-face!" exclaimed curator Nedhal Ameen. The apparent target was a telephone center a block away. Vibrations shattered glass. Two Babylonian figures toppled. "What can we do with America?" Nedhal sighed. Then, brightening: "You come again someday; maybe you can see everything, *Inshallah.*"

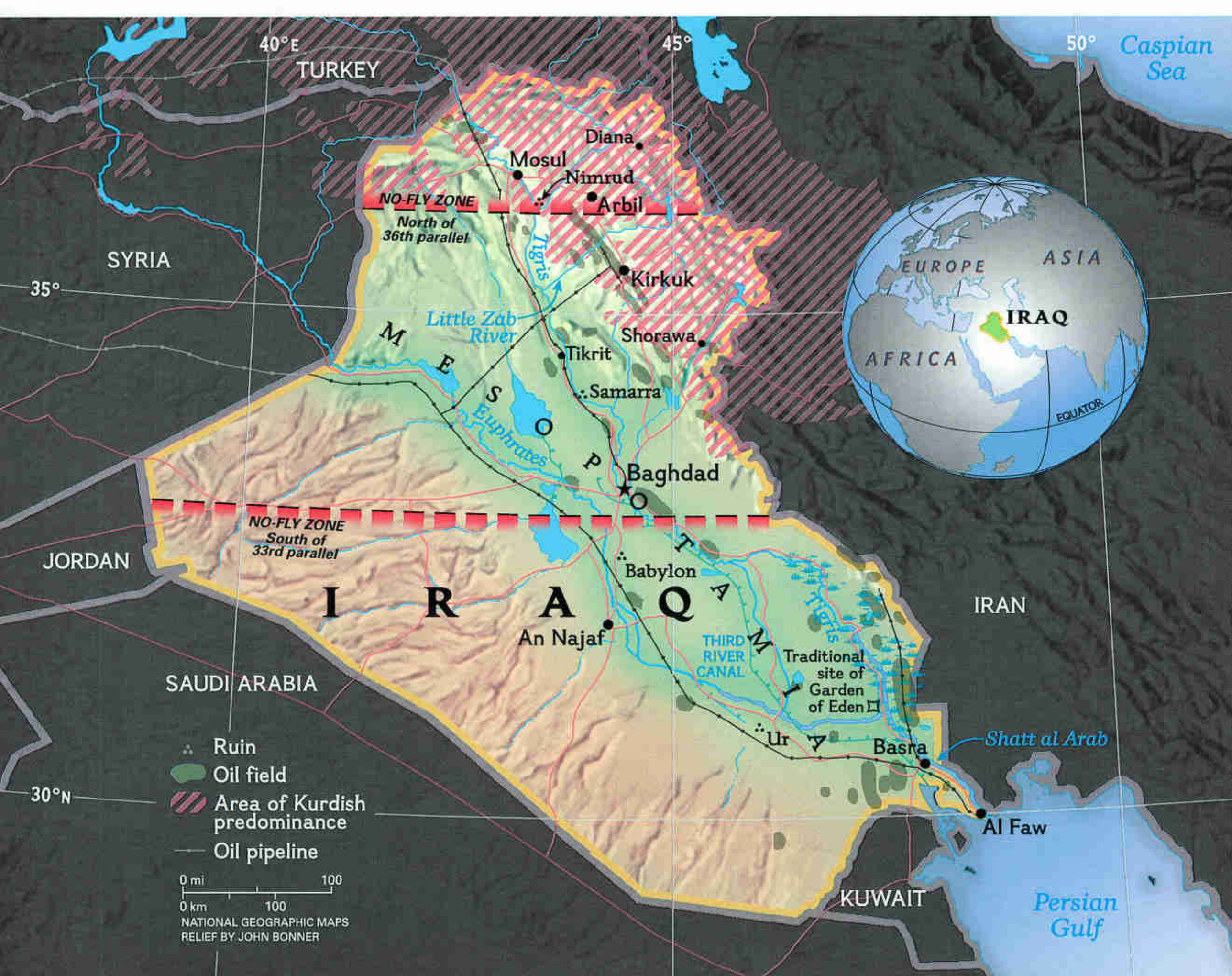
All Mesopotamian empires endured paroxysms of war and destruction; the gulf war is one more chapter. With photographer Michael Yamashita, I spent almost six weeks gauging the echoes of that war. We found southern Iraq bristling with the guns of President Saddam Hussein's army. The people, mostly followers of Islam's Shiite branch, rose in 1991 against Saddam, long their oppressor. Shiite guerrillas still mount raids against his troops.

We saw plenty of guns in the north too, but they were in the hands of some three million Kurds, the largest minority in this mainly Arab nation. In their off-and-on war with the Iraqi Army the Kurds also suffered terribly; Saddam even used poison gas, killing 5,000 Kurds in a single town. But in 1991, threatened by a new Kurdish revolt, the army retreated from the mountains of the Kurdish homeland, and today the Kurds run their own affairs.

Both the Shiites and the Kurds receive a modest measure of protection from U.S. and British warplanes patrolling no-fly zones to keep Iraqi aircraft from flying there. Iraqi gunners sometimes fire at the planes or track them with radar. The planes retaliate against military targets, though straying missiles have hit civilian neighborhoods.

That has happened, for example, in the city of Mosul, within the northern no-fly zone. One day there I asked a priest—720,000 Christians live in Iraq—if air-raid sirens made

Saddam Hussein's repulsed invasion of Kuwait in 1990 and his refusal to dismantle weapons of mass destruction have reduced a respected nation, rich in oil, to a pauper state flanked by rivals—Turkey and Iran. Observers say that trade sanctions may have cut Iraq's revenues by 90 percent.





ORNATE EXCEPTION to the fraying city around it, Baghdad's Kadhimain Mosque awaits the faithful for dawn prayers. To appease Islamic conservatives, Saddam has closed nightclubs and banned public drinking.



people afraid. His answer described a numbed populace: "They have lived with war for so many years they don't care. Nearly every family has lost someone. Life is very cheap here." In the Iranian war an estimated 500,000 Iraqi soldiers were killed or wounded; Operation Desert Storm inflicted between 60,000 and 100,000 casualties more.

When Mike and I set out, we expected to spend only a couple of weeks in Iraq. We were following the route of Marco Polo, who may have passed through the area in 1271 on his way to China. Perhaps the Iraqi government allowed us to stay longer in hope that we'd report extensively on the suffering of Iraqis under the UN sanctions. Since no airline flies into Iraq—another manifestation of the sanctions—we set off from Amman, capital of Jordan, in a hired van. Ten hours later, beside the Euphrates, the bare desert gave way to palm groves, and in another hour we were among Baghdad's modern, sand-colored buildings.

War, what war? I asked myself at first. Although Baghdad was bombed in 1991 and again in December 1998, most of the debris has been cleared. Rebuilt bridges span the Tigris.

In place of a toppled communications tower the government raised a spire with a revolving restaurant. As I dined there one night, about 125 yards up, Baghdad—home of five million people—spread out as a great disk. The slowly turning windows brought into view the stylish apartment and office buildings that oil paid for in the 1970s and 1980s, then rows of large homes bathed by street lamps. Next came a swath of darkness—a neighborhood whose turn had come to do without electricity. (Imagine your air conditioner shutting off in summer when the temperature is 120°F.)

The restaurant moved, and I beheld an enormous domed edifice, brilliantly lit, surrounded by a high wall. This is one of Saddam's new palaces; by some counts he has more than a hundred palaces and mansions. Iraqis say Saddam and his family occupy only a few; evidently the others exist to gratify his ego.

I wasn't the first journalist to ask Mohammed Fatnan, my government guide—known in the trade as a "minder"—about these Arabian Nights creations. Touchy subject. "Why do the Western media make propaganda about the palaces?" he shot back. "The royal family of Saudi Arabia has palaces. Why don't the Western media write about them?"

Mohammed's main job was to keep an eye on me and tell me what I could and couldn't do (no interviewing soldiers, for instance). He was 32, with a short beard. His salary was about 10,000 dinars a month—handsome pay before Iraq's economy sank under the weight of the embargo and two costly wars. Now a single dollar buys 1,200 dinars. So he lived in the Ministry of Culture and Information press center, sleeping on a couch. Yet if Saddam's palace profligacy angered him, he never showed it.

MOST IRAQIS were civil, some telegraphing friendship by such comments as, "I loved President Kennedy." Or, "How can I get to America?" I even heard Saddam (he's usually called by his first name) labeled "a butcher." Such things were said when I was alone with someone; no Iraqi wants trouble with the omnipresent secret police, who have been known to torture and kill citizens. Others condemned Saddam for his wars. A young man with limited English said with eloquent pith: "He need all time more war, Saddam. He like war."

That's not the view of Abdul Razzaq Abdul Wahid. A poet, he's a member of the establishment, which includes Saddam's kin, military officers, officials of the ruling Baath (Renaissance) Party, and several loyal Arab clans. "You Americans have a black idea about this man," Abdul Razzaq declared when I visited his comfortable home. "He's very gentle, very kind." And very strong. "Sometimes when he looks at me, I want to put my hands over my head because I think a knife is coming, like he's going to cut off my head."

At a Saddam birthday celebration last April 28, Abdul Razzaq delivered a glowing tribute. Saddam, who turned 62, was absent; presumably fearing assassination, he rarely appears in public. No matter; the party went on, and the Baath faithful enjoyed the huge cake.

For years Saddam has rewarded his favorites with presents of automobiles and cash (when the dinar was valuable). "I'm not rich," Abdul Razzaq said, "but I can live good."

Inflation and shortages compel other Iraqis to recycle almost everything. Among the carcasses at the Abu Mahmud Garage were two 1960s-vintage Volkswagens that looked to have fried in the desert for years. But they would



Prayer softens hard times for a family visited in a Baghdad poorhouse by Sister Olga Noel Yaquob, a Christian charity worker. Where once obesity was a national health concern, most Iraqis now survive on meager government rations. Malnutrition and disease have led to a rising death rate among children.

be on the road as soon as the Abu Mahmud salvagers had patched the floors, rebuilt the engines, sewed up the seats, and found tires Allah knows where.

"Rubbish!" exclaimed a businessman who was waiting for his own car to be repaired. "This is rubbish work! It's not for Iraqis. It's for the poorest country in the world. We used to bring in Egyptians to do jobs like this." Or, more likely, old cars were abandoned, for Iraq was a throwaway society, thanks to oil.

Cars and parts are banned under the embargo. Yet the traffic of Baghdad, this Bondo city on the Tigris, sometimes included a sporty new BMW or a regal Mercedes. "The embargo hurts just the good people," an Iraqi said. "The bad people get whatever they want."

There's no shortage of gasoline, and at ten cents a gallon it's the world's cheapest. Most of Baghdad's fuel comes from the Daura Refinery at the city's edge. Heavily bombed in 1991, it's an example of recycling on a grand scale. "I didn't have dollars to buy parts, and if I had dollars, nobody would have sold me parts because of the embargo," said Dakhar Y. Al-Khashab, the maintenance chief. "So we had to make thousands of things. That was new for us. The old way, if we needed a pump shaft, we just got it from the warehouse." He added exultantly, "The more time we spend under sanctions, the more things we produce."

People have been recycled as well: engineers into mechanics, professors into taxi drivers. The driver I got from the Al-Rashid Hotel, Samil Mahsud, owned a dressmaking business before the economy collapsed. "It was very profitable," he said. "Iraqi women spent half their money on fashion." Now he earns six dollars a day, when there's work.

Wassan Khalid Al-Ameed, a civil engineer, became a broker. I watched her dash across the floor of the Baghdad stock exchange to consult her clients. Then she elbowed into a crowd of brokers to offer a thousand shares of Baghdad Soft Drink. Iraq's biggest soda bottler was a hot



Supply overwhelms demand on a Baghdad street (above); many books are in English, once taught in schools. Middle-class Iraqis flood markets with household goods to earn cash, sometimes for exit visas. Despite the trade embargo, almost everything—medicine, new cars, an ample meal—is available for a price.





Weighed down with dinars, money changers (above) stalk a Baghdad street where foreign journalists, merchants, and United Nations officials pass by with their hard currencies. Desperate for money, a father turns to his sons, even a four-year-old, to hammer out chain links. People who beg risk jail.



number among the 96 stocks. It was selling at 87 dinars a share, about 7.3 cents. For investors, a good day at the exchange nets $33.

Iraqi women are among Islam's most liberated. Still, Wassan said, "There is a lot of resentment. Some men think this is not a job for women. But I like making my own way. I did about 10 million dinars [$8,300] in business today." And in three years she had saved 15 million dinars of her own. In depressed Baghdad, that will buy a house.

SOMETIMES Mohammed, Samil, and I ate lunch at Candles, a restaurant surviving amid the grimy windows of long-closed airline offices. Lunch is Iraq's main meal, so we gorged—skewered lamb or chicken, rice, eggplant, tomatoes, hummus, baba ghanouj, olives, disks of bread, tea. Cost for the three of us: six dollars.

As we left, we would be accosted by a wisp of a girl. Only six, Sara was the youngest of four children living with a widowed mother. "We never used to have that," Samil said of child beggars. He began to take some of his own lunch to her, and I contributed wads of dinars.

Though money is scarce, no one should be starving, even though Iraq in normal times produced only 30 percent of its food. Sara's family receives flour, rice, tea, sugar, cooking oil, even soap. These began to be imported in 1997 under the UN's "oil-for-food" program. To relieve suffering, the UN Security Council eased the sanctions, permitting Iraq to sell oil to get money for food, medicine, school supplies, farm equipment, and spare parts for essential industries. Iraq decides what to buy, but the UN keeps the checkbook and must approve all purchases. At present Iraq can sell 5.2 billion dollars' worth of oil in a six-month period. Some money goes to persons who suffered losses in Kuwait; two-thirds is reserved for humanitarian goods.

The oil-for-food program has boosted rations from 1,300 to 2,000 calories a day; that's close to the average intake of many Western nations. Nevertheless, says the UN, perhaps 20 percent of Iraqi children are malnourished, missing protein, vitamins, and minerals.

Journalists are often taken to the 320-bed Saddam Children's Hospital—one of numerous institutions bearing the president's name—to hear reports such as Dr. Mazin Shimar offered. "In this hospital we have two or three deaths a day," he said. "It used to be one a week." The Ministry of Health claims that more than a million children under five have died as a result of the embargo.

Such figures have helped win support in the U.S. for Iraq's campaign to end sanctions. "The death and suffering . . . seems to us morally intolerable," the United States Catholic Conference has declared. Antiwar activists have condemned the sanctions as "genocidal."

"I'm sure that Saddam Hussein decided 'we have to show a lot of deaths,'" says Richard Garfield, a public health specialist at Columbia University in New York. "It happened that they had a lot of deaths. But their information was so poor they didn't really know how many." Using demographic and other studies, Garfield has estimated the number of excess deaths of children under five from the start of sanctions



View from a minaret reveals the dense, stone-colored hive of the old quarter of Mosul, Iraq's front-line city in the conflict against the Kurds and their Western protectors. Air-raid sirens and antiaircraft fire regularly echo through the narrow streets as U.S. and British planes sweep close, patrolling the northern no-fly zone to prevent Iraqi aerial incursions.



in 1990 until March 1998. His most likely figure: about 227,000. He believes the number of deaths per thousand children more than doubled from 38 in 1990 to 87 in 1998. "It is a remarkable statement of how bad conditions are," he said. A UN survey puts the number of deaths even higher, 131 per thousand, during the past five years. The causes of death include malnutrition, a decline in immunizations, and polluted water. Water systems are in bad shape; mains leak, pumps don't work. And both water and sewage systems are handicapped by the power outages.

Many observers put some of the blame for deaths on Saddam. He delayed more than a year before agreeing to the oil-for-food program proffered by the UN. His government paid scant attention to repairing water systems; most of the new pumps ordered under the program were sitting in government warehouses during my visit. More than 275 million dollars' worth of medical equipment had gathered dust for months. Some highly placed UN diplomats suspect that Saddam was more interested in making propaganda about the deaths than in breaking bottlenecks.

Sanctions were conceived as a means of forcing Saddam to give up the weapons of mass destruction—chemical, biological, nuclear—that he was believed to possess or to be making. U.S. officials say Saddam intended to use such weaponry to dominate his oil-rich neighbors around the Persian Gulf. But after the 1998 bombing of Iraq, Saddam refused to let the UN weapons inspectors into the country. So, for now, the sanctions saga has no end.

All the same, the U.S. is convinced that the embargo applies pressure on Saddam. And besides, a State Department official says, "If he were handling his money instead of the



ACCESSORIZED WITH A KALASHNIKOV, a Kurdish wedding guest intends to protect family and friends if a feud erupts between attending clans. Peace prevailed, grounds for celebrating with a few rounds from her noisemaker.



UN, he'd go right back to making weapons."

To a 25-year-old woman named Rana, whom I met one day in Baghdad, sanctions were just one more source of grief. "We are a broken generation," she said. "My generation opened our eyes on war, the war with Iran. We all saw men coming home without an arm or a leg. We have only small dreams, and we are losing even those. Why does the embargo have to continue? Haven't we suffered enough?"

Another question might be: Haven't we had enough of propaganda? It's a major industry. Take, for example, the Mother of All Battles, as Saddam called the fight against Operation Desert Storm in 1991. Who won? A new statue of Saddam—there are at least three recent ones in Baghdad—answers the question. He stands in an army uniform over the flattened faces of the gulf war leaders arrayed against him: President George Bush, Britain's Margaret Thatcher, France's François Mitterrand, Kuwait's Sheikh Jabir, and King Fahd of Saudi Arabia. The message of these puny pancakes: I trampled you.

"A big battle was fought between Iraqi tanks and American tanks, and Iraq won," a man of about 50 assured me. He may have believed Iraq won. Or maybe he *wanted* to believe, for Iraqis are a proud people. In any case, the news as presented by Iraqi television didn't acknowledge the huge number of casualties or the loss of 2,100 tanks. And no foreign television reports reached Baghdad; owning a satellite dish is forbidden.

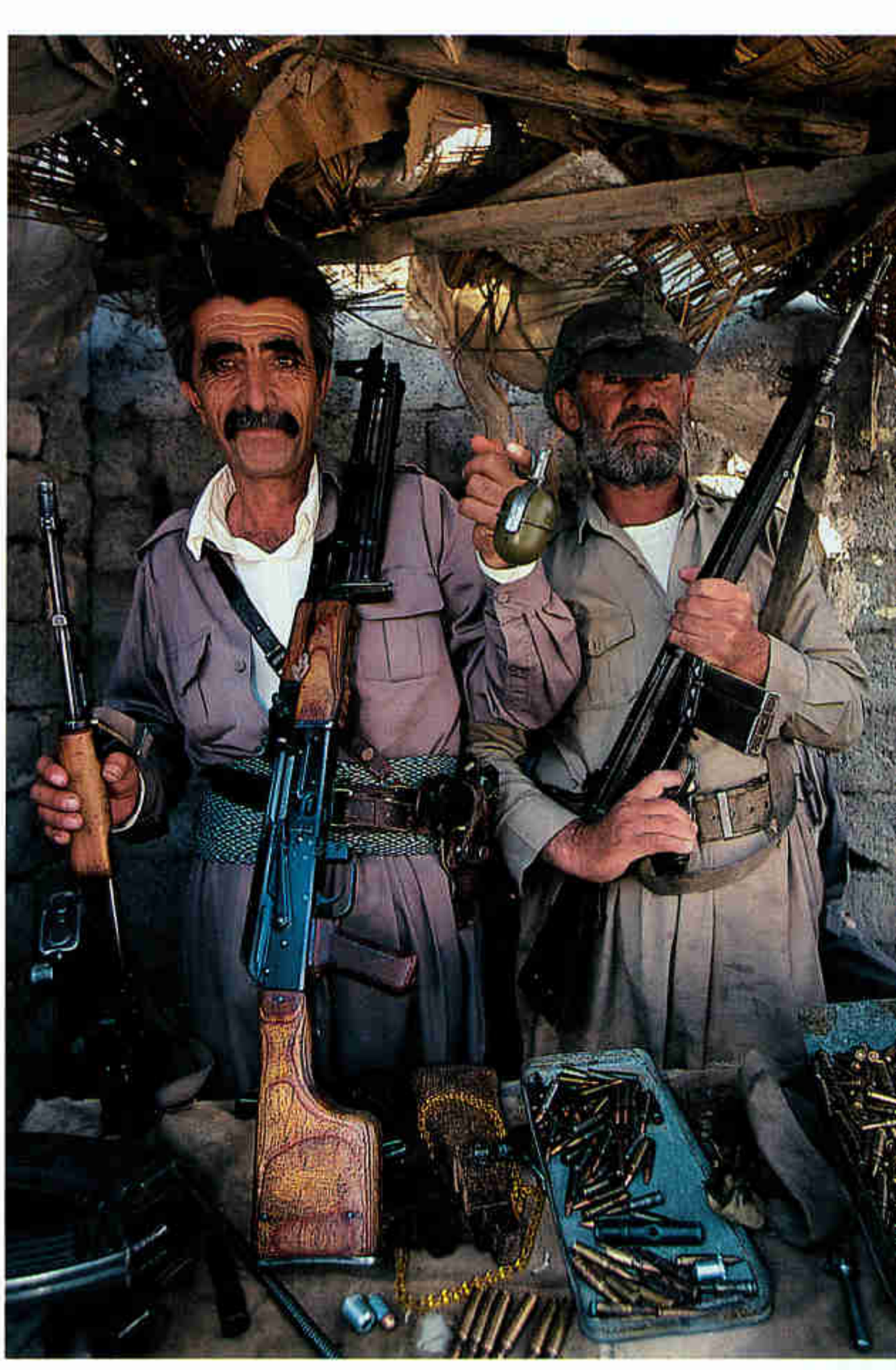
FIGHTING has never entirely stopped in southern Iraq. Desert and marsh, with a scattering of modest cities, it is the stronghold of the Shiites, who rose against Saddam as the gulf war ended. Helicopters and tanks quelled that revolt, but guerrillas still appear at night to attack an army outpost or a Baath Party headquarters. Dissidents living outside the country, who receive smuggled reports, say troops have machine-gunned demonstrators in cities and used artillery against villages.

The Shiites are a majority chafing under minority rule. Among Iraqi Arabs, they outnumber Sunni Muslims about two to one. But Sunnis dominate in Saddam's regime and the Baath Party. The Baathists began in the 1970s to curb the influence of Shiite clerics, executing several. Seminaries were closed, religious publications censored. Retaliating, militant Shiites have twice tried to assassinate Saddam.

I asked the Ministry of Information several times to let me go south, and at last permission came. On the surface all seemed peaceful as Mohammed and I headed toward the old port of Basra, 350 miles southeast of Baghdad. Most of the way the road followed the Tigris. Irrigation canals laced the sand, nourishing wheat fields and plots of onions. Shepherds guided their flocks to grass. War, what war?

But the farther south we went, the more often we encountered the army. Small fortresses appeared in the desert every couple of miles. Automatic weapons were trained on the road from sandbagged sentry stations. Expatriate Iraqis say guerrillas are most active in Iraq's southeastern corner, near the Iranian border. Iran's Shiite government succors some of these "national resistance fighters."

Amid this cauldron of trouble is located, according to Iraqi lore, the Garden of Eden. I wanted to see it, but we needed an escort to





Borderline trade practices operate on the Iran-Iraq frontier as a Kurdish mule train loaded with UN rice and milk powder prepares to slip into Iran. It will return with manufactured goods. Thirty dollars buys a rifle in a border village (opposite). Fifty cents gets a grenade. "Good for fishing," says the seller.

paradise: a soldier with a Kalashnikov.

The garden lies beside the Tigris where it joins the Euphrates to create the Shatt al Arab, or Arab River. The soldier stood guard as I went into the walled enclosure. Just a postage-stamp park, it harbored an ancient gray snag of a tree, long dead, which some Iraqis believe is as original as original sin. Near it grew a healthy younger one. Neither would have produced an apple for Eve to pluck; they yield a plumlike fruit, the *nabug*. Still, many Muslims regard this spot as sacred, for in Islam Adam is a prophet.

Like Adam and Eve expelled from paradise, thousands of Iraqis have been driven from the marshes that spread between the Tigris and Euphrates. The Marsh Arabs, or Madan, have dwelled in those wetlands for at least 5,000 years. They built reed houses, fished, hunted waterfowl, grew rice. Today many of the Madan, who may number 200,000, have fled to Iran. Iraqi helicopters and artillery blasted their villages in 1992, possibly because guerrillas had found refuge in them. It was in response to these attacks that U.S. and British planes began to patrol the southern no-fly zone. Nevertheless, earlier this year, the UN Commission on Human Rights reported new assaults by Iraqi ground forces using mortars and artillery. Many houses were burned or bulldozed as Saddam forced the Madan to move into collective towns where they could be controlled.

Worse in the long run, Saddam is draining the wetlands that sustained the Madan way of life. As a result almost all of the New Jersey-size Madan homeland is already dry.

Mohammed took me to a Madan village—on dry land—to meet Sheikh Abbas Chiad Al-Imara, leader of a tribe, as he told me, of "3,000 fighters." I sat cross-legged on a carpet beside the sheikh, a handsome man in a gold *abae,* or robe. Twenty tribesmen joined us.

"Now that the people are moving to towns, the government will bring us electricity and schools," the sheikh said. "What is happening is



good for us." I looked at the tribesmen around us. Their bladelike faces registered neither approval nor protest. UN reports say some Madan are being held hostage by the army to assure tribal obedience; perhaps kin of these men were among the prisoners.

CENTURIES ago ships from India sailed up the Shatt al Arab from the Persian Gulf, bringing gems and spices to Basra. More recently—before 1991—the city's casinos and bars drew Muslims from nations where such things were forbidden. None of that sparkle survives; Basra has shrunk into a shabby city of dust-colored dwellings and make-do sidewalk bazaars.

In a hotel by the river I listened at night to cars clack-clacking across loose sections of a pontoon bridge. Destroyed in the gulf war, Basra's bridges, unlike those of Baghdad, have never been rebuilt. Nor has Basra's port been cleared of ships sunk by Iranian artillery in 1980. Iraqis say such neglect is the price Basrans pay for rising against Saddam in 1991. "One of the biggest factors in Saddam's mentality is revenge," said a dissident now living in London. "He will never forgive them for revolting." Revenge motivated the Basrans as well; in 1991 many slew security agents and Baath Party officials to avenge the deaths of relatives.

In the 13th century Marco Polo wrote that Basra grew "the best dates in the world." In modern times dates were a major export. But close to the Iranian border, where great plantations had stood, I saw only miles of stumps, all that was left after Iraq and Iran fought savagely in this area in the 1980s.

Seven hundred families had lived in the village of Sihan, but only one dwelling remained. In its yard I saw boxes of corroding



The gloom deepens in war-scarred Basra, a once booming port city in the south, where merchants' houses now decay from neglect. Saddam has let the city rot as punishment for being a center of opposition during the 1991 uprising of the south's predominantly Shiite population. Hatred of the Sunni-led ruling party persists, evidenced by sporadic riots and bombings.

ammunition. "We collected those around the house," Ihsan Baki said casually. He was shoeless; such money as he earns today comes from fishing. In land, at least, Ihsan and his brothers were well off, with 59 *donems*, or 36 acres. "Our grandfather planted many of the date palms that were here," he said. "We harvested 150 tons of dates a year. We had orange and pomegranate trees too." All gone, destroyed in the Iran-Iraq war. Ihsan and his brothers are slowly replanting palms, but Ihsan believes 20 years will pass before they harvest 150 tons again.

IN NORTHERN IRAQ the writ of Saddam extends only a few miles beyond the city of Mosul, whose old quarter rises from the Tigris like a tottering stack of crates. In 1991 Iraqi officials as well as troops withdrew from the country's three northern governorates, the mountainous heart of Iraqi Kurdistan, as the Kurds rose in a new anti-government campaign.

Passing through a couple of military checkpoints, I felt as if I had entered a different country. Kurds were running the three governments; Kurds were the police. They didn't require me to travel with a minder. Even the language changed; a distinct ethnic group, Kurds speak a tongue laced with Persian.

An ancient citadel rises in Arbil, one of the chief Kurdish cities, and from a café there I looked across jumbled roofs. Satellite dishes peered back; unlike other Iraqis, Kurds receive news from all over the world.

Blue-and-white signs announced UN agencies that were helping Kurds recover from decades of war and neglect. WFP distributed food, UNESCO built schools, UNICEF cleaned water supplies. A poultry farmer named Hamadamen Kadir thanked FAO for the soya meal that fattened his 7,000 broilers. The oil-for-food program paid for everything.

Life is much improved for Kurds, but they are, as ever, disunited and prone to settle disputes with guns. Everyone seemed to have a Kalashnikov. I saw two women at a wedding with rifles slung on their shoulders, and when I looked into the car that would whisk the new couple away, I saw a rifle on the front seat. Some Kurds carried weapons because their families were involved in feuds, others because they were *peshmerga*—warriors.

"If something happens suddenly, we are ready," said a peshmerga, strolling through a bazaar with his weapon. He belonged to the militia of the Kurdistan Democratic Party, or KDP. Its chief rival for control of Kurdish affairs is the Patriotic Union of Kurdistan, or PUK. They've fought several battles since Iraq pulled out, and although they've agreed to cooperate, it's plain they don't trust each other. KDP leaders are crooks, a PUK official told me. A KDP official said Iran is supplying arms to the PUK. Could be. Iran, Syria, and Turkey, which have Kurdish minorities, have long been accused of meddling in Iraqi Kurdistan to assure that the situation remains unstable.

"They don't want to see us [Iraqi Kurds] get autonomy," one KDP official said, "because then their Kurds will demand that too." Both the KDP and the PUK say their goal isn't independence from Iraq but the right to control their own affairs—under a government not

TIMELESS PLEASURES of a playground divert families visiting the ruins of Samarra, a ninth-century capital of the Abbasid dynasty, rulers of Iraq for 500 years. An enormous spiral minaret commands the site.



run by Saddam Hussein, of course. Turkish Kurds have long fought to establish an independent domain, sometimes engaging in terrorism.

I went northeast to the small city of Diana, about halfway between Arbil and the Iranian border, on a road that climbed corrugated mountains ribbed with limestone. Beneath these bony ramparts young wheat struggled to get a roothold in fields of rubble.

Diana's bazaars brimmed with cheap Iranian carpets and plasticware. Other shops offered arms. Want to see something in hand grenades? How about these? Fifty cents apiece. Land mines? Same price.

Everyone who fought in these mountains—Iraqis, Iranians, Kurds—laid mines. Millions remain in the earth. In a village of mud and stone, a man showed me his hands. Five digits were missing. He had also lost an eye. "I was trying to clear a field so I could plant," he said. "I saw this thing and I lifted it and. . . ."

A thin woman standing in a doorway said, "Seventeen people of this village have been killed or hurt by mines. This child's father"—she put a bony hand on a boy about ten—"was one of those killed." The boy looked at me with large, sorrowful eyes.

"Clearing the mines could be a matter of life and death for these people, not only because they might be killed but also because they need the land to farm," said Graeme Abernethy, who was with me. Trained as a sapper in the New Zealand Army, Graeme led a team of de-miners brought in by the UN to teach their hazardous craft to Kurds.

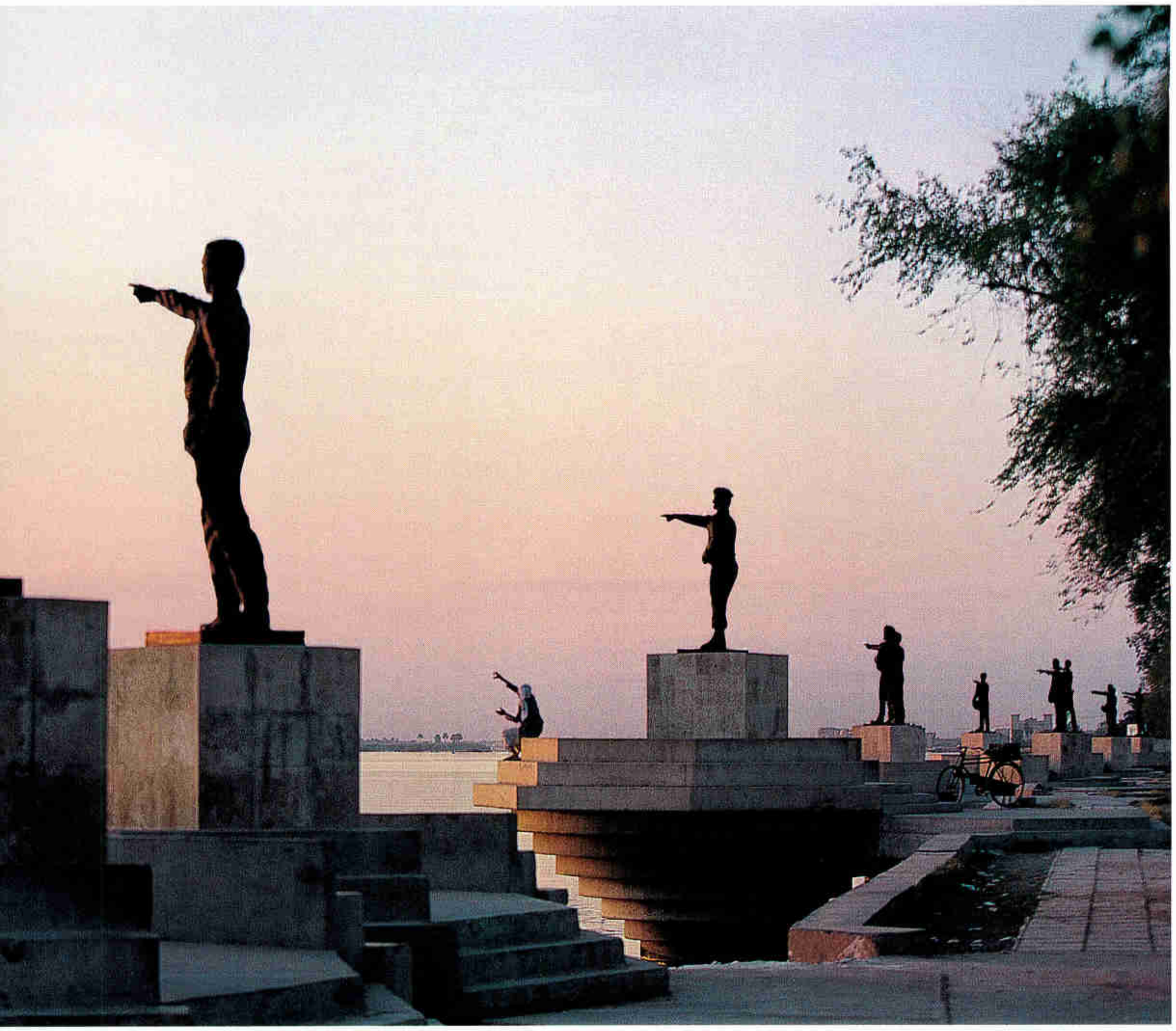
"If you take out one mine, you may save the life of one person," said Reger Sabah, a Kurdish de-miner. "It is not dangerous if you are careful." Reger earned $150 a month—good pay in Kurdistan. He wore a heavy Kevlar torso cover and a plexiglass face guard. Standing well away, I watched him work. On his knees he marked off an area measuring about one foot by three feet. He checked for trip wires, trimmed the grass, and gently felt the earth. Finally he passed a metal detector over the area. Satisfied, he advanced another foot. In a day he'd cover perhaps ten square yards. Dogs that sniff explosives can cover more territory, and some are being trained in Diana now.

So far the UN has spent more than six million dollars (from Iraqi oil money) but has sanitized only a fraction of the 3,000 known fields. Decades will pass before Kurdistan is cleared—if ever—of mines, grenades, unexploded mortar shells, and other ordnance.



A finger-pointing war memorial lines the Shatt al Arab near Basra on the Iran-Iraq border. The 61 statues represent military commanders who died during the 1980-1988 Iran-Iraq war, which ended in stalemate. With its economy in tatters, its youth mired in ignorance and disease, and its leader a brutal tyrant, Iraq remains in full-scale retreat from the glories of its past.

Some Kurdish farmers, meanwhile, are moving into new homes. The UN agency known as Habitat has supplied materials for rebuilding 1,100 of the more than 4,000 villages destroyed by Iraqi troops in the 1980s. In one, Shorawa, I sat on a carpet drinking tea with Khawam Karim, a bluff fellow with a sun-bronzed face. Khawam's family had lived in Shorawa for "20 grandfathers," as he measured time. In 1987 soldiers drove out the villagers. "We were made to go live in a collective town," Khawam said, "even though we hadn't done anything against the government." Saddam had concluded that the Kurds might be controlled if corralled—the same treatment the Marsh Arabs are getting now.



I asked Khawam if he was afraid that Saddam's soldiers would return some day. "It is not in our power to prevent that," he answered. And then, looking hard at me: "The situation is in your hands—you Americans."

Many Kurds wonder how long they will be protected by U.S. and British aircraft patrols. Friends have abandoned them before when Middle Eastern alliances shifted.

THE TRIP BACK to Baghdad took me through Kirkuk. Around the city half a dozen infernos blazed, burning waste gas from one of Iraq's major oil fields. Iraq has more petroleum reserves than any other nation except Saudi Arabia.

Reminded of that wealth, an engineer told me one day: "Once we hoped that by the end of this century Iraq would be an advanced country, that it would move up from the Third World group. We could contribute something to the world in any field—science, the arts—because we have the background. We have 7,000 years of history. We introduced mathematics; we watched the stars and made a calendar." And invented the wheel. And writing.

Oil indeed could have made Iraq a modern nation. Oil could have bought anything. But it did not buy peace. Instead it paid for weapons. And when Saddam threatened the West's main oil suppliers in the Persian Gulf, Iraq found itself a defeated state and a pariah.

In some future time archaeologists will scour the record of Iraq at the end of the 20th century, as they have scoured the records of King Sargon, who founded the first Mesopotamian Empire, and Hammurapi of Babylon, the giver of laws. And when listing the achievements of Saddam, they will write: He built a lot of palaces. □

TIGERS IN FOR THE KILL

TIGER SHARKS CAN MAKE LIFE BRUTAL AND BRIEF FOR ALBATROSS CHICKS LEARNING TO FLY AT HAWAII'S FRENCH FRIGATE SHOALS.





Article and photographs by
BILL CURTSINGER

From an anchored boat I scanned the shore of East Island for albatross chicks. There were plenty to see. These largest of seabirds spend most of their lives far at sea, but at nesting time they concentrate ashore on remote islands like this one, at French Frigate Shoals in the Hawaiian Islands. Two albatross species, the Laysan albatross and the black-footed albatross, had hatched their chicks four or five months earlier.

I had not come to the Hawaiian Islands National Wildlife Refuge to look for birds. I was looking for sharks—like the one whose fin showed where it was cruising a few yards from shore. These big tiger sharks show up at the peak of the fledging season, looking to eat young albatrosses lingering in the shallows. During the months of June and July the two separate worlds of bird and fish come together.

Oblivious to the danger, the 30 or 40 chicks knew only that their departure time was now. I watched as some of the birds caught the wind, sailed out clumsily over the water, gained momentum, and flew off into the wild blue yonder, safely beyond the danger zone. Others landed a mere 30 yards from shore, where the situation was wilder. A shark would move in and a hapless chick would disappear in a microsecond, before I could even raise my camera. These unfortunate birds, which were not in the majority, simply landed in the wrong place at the wrong time.



Two species of albatrosses—Laysan (above) and black-footed—fledge at about five months. But when flying from sand to sea, they face a life-threatening hurdle—a hundred feet of water alive with tiger sharks, which migrate here each June to prey on the birds.

Tiger sharks routinely start feeding at twilight, but here they fed on albatross chicks all day. The morning of June 20 was a fairly typical one. Between 6:45 and 7:45 a.m. three Laysan and thirteen black-footed albatross chicks flew from the beach at East Island. In that hour five of the sixteen fledglings were attacked and killed. Another was attacked and escaped. As the day progressed, more wind meant more flights. And the stronger winds gave the birds an extra edge, lofting them far offshore, beyond the danger zone. The victims would fly, splash down, and preen their wings, unaware of the danger until disaster struck.

The sharks were often not as efficient as one might expect. I saw them miss their prey by several feet on the first try, spiral around for another assault, and zoom in for the kill. Sometimes the chick would get away before the second attack. One distinctive shark with a knob on its dorsal fin wheeled around for a second pass. Not seeing the bird, it slammed into my small Boston Whaler and attacked the outboard propeller. This was discouraging since I prefer to dive with sharks to photograph the underwater action. Based on the behavior of this particular shark, I decided to use a remote camera system from topside.

Even if a bird survived an initial attack because the shark missed its target, the young albatross would often stay on the water. Some chicks even faced their pursuer and feebly pecked at the shark in a vain effort to ward off the 14-foot predator. Then they disappeared, dragged underwater, swallowed whole. A few feathers remained drifting in the water along with bits of flesh that sank slowly to the bottom, erasing all evidence of the recent drama.





First flight is the last flight for one out of ten fledglings. The unfortunate novice fliers are often the scrawniest ones or those that try to ride whispers of wind too weak to carry them over the danger zone.





Feathers float in a tiger's wake, a familiar scene near albatross roosts. "It's rare to actually see sharks feeding in a natural setting like this," says photographer Curtsinger. "They were just snacking, but capturing this was a feast for me."

Bill Curtsinger photographed "Pirates of the *Whydah*" for the May 1999 issue.

AT 22,000 FEET

CHILDREN OF INCA SACRIFICE FOUND FROZEN IN TIME

FIVE CENTURIES AFTER INCA PRIESTS SACRIFICED THREE CHILDREN ON A PEAK IN ARGENTINA, ARCHAEOLOGISTS FIND THEM FROZEN TO NEAR PERFECTION, ACCOMPANIED BY BREATHTAKING TEXTILES AND ARTIFACTS.

By JOHAN REINHARD *Photographs by* MARIA STENZEL



Eternity Bound

Richly wrapped Inca child sacrifices were more than just gifts to the gods. They were ambassadors, sometimes volunteered by their families, sometimes taken from them. The boy found on Cerro Llullaillaco (right), perhaps eight years old, wore a tunic big enough to grow into, carried extra sandals for his journey in the next world, and bore a gift more prized than gold: a spondylus-shell necklace (above). Harvested off Ecuador's warm shores, spondylus shells were strongly associated with water, an especially precious resource in arid Andean regions. Because mountain gods controlled weather and gave or withheld life, these peaks were fit settings for sacred rites.

The figurines below—two males and three llamas, shown here about three-fourths their actual size—may have been offerings to the gods, representations of the sacrificial victims, or even guides to the afterworld. No one knows, since the Inca left no written history. Most of what is known of their culture comes from early Spanish accounts and archaeological finds such as these.









ARCADIO MAMANI is one of the strongest men I've ever worked with. He grew up in the mountains of southern Peru and has accompanied me on a dozen high-altitude archaeological expeditions, including three to the Ampato volcano, where the Inca Ice Maiden was found in 1995.* Lean and muscular, Arcadio has phenomenal endurance: He often keeps digging long after other team members stop. A proud follower of his family's traditions, which have roots in those of the Inca themselves, he is always the one to make offerings of food and drink to the mountain gods, asking support for our work. And indeed Arcadio seems to have developed a sixth sense about archaeological sites.

This time we were excavating Inca ruins on the summit of Cerro Llullaillaco (pronounced Yu-yai-YA-ko) in the Andes. At 22,110 feet it is the world's highest archaeological site. We had waited four days for fierce winds and a snowstorm to abate while encamped in a snow bowl 200 feet below the summit. This was followed by a day and a half of digging. It seemed only fitting, therefore, that Arcadio was the first to shout the word that caused all of us to stop work instantly: "Mummy!"



JOHAN REINHARD (RIGHT)

Excavating a burial ground near Base Camp, the author (above) takes a breather from the work on the summit, another 6,000 feet up. While this lower site had been raided by treasure hunters, the much less accessible summit (right, foreground) had kept looters at bay long enough to protect the highest Inca sacrifice ever found.

I put down my notebook and hurried over to the place where Arcadio was digging. He and his brother Ignacio had uncovered a section of a stone-and-gravel platform on the most exposed part of the summit. There, more than five feet down, was a bundle wrapped in textiles—the frozen body of an Inca ritual sacrifice, a boy about eight years old. Beside his left arm lay a sling and two pairs of sandals, objects presumably intended to accompany him on his journey to the afterlife. Parts of his arms, hands, and feet were visible and were in excellent condition; his knees were drawn up in a fetal position and bound tightly with a cord. He wore moccasins and white fur anklets, which looked as if they'd been made only yesterday. A broad silver bracelet covered his right wrist.

I felt a surge of exhilaration, followed by intense relief. Only two weeks earlier we had excavated an Inca ritual site at 20,112 feet on the summit of Nevado Quehuar, not far from Llullaillaco, where we found the battered remains of a human sacrifice. Treasure hunters had preceded us. To save time, they had used

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*See the author's story on the mummies found on Ampato in the June 1996 NATIONAL GEOGRAPHIC.



The Inca Empire

In its short life of only about a hundred years, the Inca Empire came to stretch 2,500 miles—roughly the distance between New York City and Los Angeles. By the Spanish conquest in 1532 the Inca, a small ethnic group based in Cuzco, Peru, ruled more than 12 million subjects, of 100 different cultures, speaking at least 20 languages. The Inca were not the brutal conquerors the Spaniards were. They used gifts as well as spears to demonstrate power to potential subjects. Inca textiles, for example, inspired awe among villagers. Once in charge, the Inca assimilated new peoples with remarkable effectiveness—allowing local leaders to keep their posts but taking their sons to Cuzco for training, exacting a "labor tax" from subjects but repaying with goods, honoring local gods and religious practices but commingling them with Inca beliefs and rituals. Child sacrifices were part of this approach. The Inca obtained children from throughout the empire and rewarded their families with positions or goods. Sacrifices were unifying events; children often were taken to Cuzco for celebrations before processions bore them on long journeys and up massive mountains to sacrifice sites.







Mt. Everest
29,028 ft
8,848 m

Cerro Llullaillaco
22,110 ft
6,739 m

Mt. McKinley (Denali)
20,320 ft
6,194 m

Mont Blanc
15,771 ft
4,807 m

Mt. Fuji
12,388 ft
3,776 m

GORDON WILTSIE (LEFT)

As we worked our fingertips became raw.



GORDON WILTSIE



Nearly 2,000 feet higher than Alaska's Mount McKinley and 100 miles from the nearest town, Llullaillaco (opposite) took five bone-jarring driving days to reach—with breakdowns. A truck with a dead battery is pushed back to life (above left) on the way to the 16,000-foot Base Camp. A team member races nightfall back to camp (above) after exploring a nearby Inca ruin.

dynamite to break open the grave, blowing the mummy's head off in the process. I was anxious to prevent such destruction on Llullaillaco. The sad reality is that few high-altitude sites in the Andes have escaped some looting—it's impossible to guard all routes to the summits of massifs like Ampato and Llullaillaco. The only way I see to ensure that the contents of these burials are not lost forever is for archaeologists to excavate and preserve them.

Twice again during 13 arduous days on the summit, I would experience the pulse quickening that comes with a landmark discovery. In addition to the boy, we unearthed two more frozen Inca sacrifices, both girls. Until then the only other well-preserved Inca female mummy to have been recovered was the Ice Maiden. With the Llullaillaco finds we tripled the number. We also found 20 clothed statues, half as many as were previously known. Each was found undisturbed in its proper context in the ground—an archaeologist's dream.

Later, when Carlos Previgliano, a radiologist at the State Computer CT-scan Society in Salta, Argentina, performed CT scans on the bodies, he said they looked like "people who had died and been frozen a short time ago." As such, the children of Llullaillaco are in a category of their own, and I doubt that more perfectly preserved mummies will ever be found.

The Inca presence in this region is thought to have begun sometime after 1471, and it lasted until the Spanish conquest in 1532. I had climbed Llullaillaco twice in the mid-1980s and had surveyed Inca ruins leading to it from 15 miles distant. I knew that to have any chance of success in the extreme cold and thin air on the summit, I would need the most experienced team possible. So I recruited six of my old Peruvian partners and three Argentines, including archaeologist Constanza Ceruti, deputy director of the expedition, who had climbed 55 peaks in only three years in her search for high-altitude ruins.

We spent five days acclimatizing, ferrying loads from Base Camp at 16,000 feet to higher camps. On the ascent we investigated Inca way stations, including one at 17,200 feet that was well off the normal route used by climbers. Many of the buildings there, made of carefully laid stones, were virtually intact. We found remains of fireplaces and utilitarian pottery, evidence that the Inca had used the site as a resting place and storage facility before making their summit ascent.

By good luck the spot I chose for Camp One, at 19,200 feet, proved to have a large pool of water. Anyone who has had to heat ice to

Would we find anything on the summit?





make water at high altitudes knows what a boon it is to have abundant water at hand. Although the setting made for one of the most pleasant high camps any of us had known, the effect of the altitude was brought home when one member of the group developed life-threatening pulmonary and cerebral edema. Only a hurried descent to a much lower level saved him.

At 19,200-foot Camp One a slow-motion morning (above left) and a time-lapse night (above) conceal the difficulties encountered on Llullaillaco. On the summit the team gets socked in by a snowstorm and hurricane-force wind gusts. When all is clear, excavating begins (right) near the remains of two stone huts. The three mummies are found in bedrock crevices, buried under rock, sand, and volcanic soil, which makes the digging easier than expected (far right).

ONCE ON THE SUMMIT, which is bisected by the borderline between Chile and Argentina, I first had to determine where the Inca ruins lay. Using the GPS (Global Positioning System), a compass, and a large-scale military map, I determined that all were within Argentina. Then we began working. The digging, much to our surprise, was relatively easy. High winds kept the site free of much snow, and the soil was dry and workable. Some members of the team began a competition to see how many swings of a pick or scoops of a shovel they could make before stopping to rest. This exuberance wore off by the second day, when the feeling began creeping over me that all the effort of mounting this expedition might have been for nothing. Then Arcadio found the mummy.

About two feet above the body, he unearthed three miniature llama figurines, one made of silver and two of spondylus, a thorny oyster found in the warm ocean waters off the Ecuadorian coast more than 2,000 miles to the north. The Inca may have offered the llama figurines to ensure the fertility of their herds; spondylus shells evoked the ocean and thus life-giving water. Two male figurines, one of spondylus and one of gold, had been placed in front of the llamas, as if leading them. These male statues may have represented either the deities believed to be the ultimate owners of livestock—often the mountain gods—or the Inca nobles responsible for overseeing the royal herds dedicated to the gods. A rare necklace of carved spondylus pendants surrounded the statues.

Before we'd finished excavating the boy, Rudy Perea, a Peruvian archaeology student, and Antonio Mercado, an Argentine student, uncovered another mummy a few yards away. It was a girl of perhaps 14. Beautifully preserved statues and ceramics were buried with her. The most startling object was the girl's headdress, a full-size version of one on a silver female figurine (page 53) found beside her.





JOHAN REINHARD (ABOVE AND LEFT)

The headdresses were made of white feathers attached to a woolen skullcap.

Surprisingly, a man's tunic was draped over the right side of her body—a rare find both because of its nearly perfect condition and because of its archaeological context. Such tunics denoted high status and probably belonged to Inca nobles or were given as gifts to provincial leaders. But what was it doing with a female human sacrifice? Possibly the girl's father wanted his ritual attire to accompany her into the realm of the gods, or, as I believe, the tunic was an offering to the deity with whom, in death, the girl would reside.

Later, while we were preparing to put the mummy into the freezer at Catholic University in Salta, we examined her more closely. A hush fell over the room as I removed her head cloth, revealing her face. For an instant, time stopped while I stared in awe at her beauty. Her hair was stylishly braided, and she looked as if she were sleeping. But it was her hands, perfectly lifelike, that affected me most.

"Look under her nose; there are pieces of coca leaves," said Ruth Salas, an archaeologist from Peru's Museum for Andean Sanctuaries, where the Ice Maiden is kept. These leaves, sacred to the Inca, must have been placed beneath her nose right after she died. We removed the man's tunic draped over her side, wrapped her in cotton cloth, then plastic, and placed her in the freezer with hardly a word.

As the work on the summit continued, our fingertips became raw, and for weeks afterward it was painful even to tie shoelaces. Most days the wind began rising around noon. Constanza Ceruti and Jimmy Bouroncle, one of the Peruvians, were in charge of keeping notes, and more than once I saw them grabbing at wind-lashed pages. At times the windchill temperature dropped to minus 35°F, and even the indefatigable Arcadio was forced to quit early.

The conditions only increased my respect for what the Inca had accomplished—not only digging the graves but actually building structures more than four miles up, using stones found at the summit. Near the tombs, we excavated a two-room stone building in the lee of a volcanic outcrop; it must have



JOHAN REINHARD

provided shelter for the priests who conducted the sacrifices. Inside were grass mats—insulation for sleeping on the cold floor. We found llama dung above 21,000 feet, suggesting that the Inca used these pack animals to carry up some building materials, such as wooden beams, as well as jars of water and *chicha* (corn beer), food, statues, and other ritual objects.

The Inca made good use of the bedrock on the summit, placing the bodies and ceremonial offerings in natural niches they had cleared as deep as ten feet. Excavating one such hole, Orlando Jaen, a Peruvian archaeology student, had to perform gymnastic contortions as he dug deeper. "This is unbelievable," he shouted, and we all converged to see that he had found a row of multicolored feather headdresses—four female statues buried in a single line. More digging led to a telltale bundle. To our dismay, the outer covering was charred: The mummy had been struck by a lightning bolt that had penetrated more

Her feet were



than four feet into the ground.

Once we'd removed and measured the statues, we debated how best to extract the body from the narrow hole. I decided that the safest alternative—at least for the mummy—was to lower Orlando into the hole by his ankles. When we pulled him out, he would be able to prevent the bundle from scraping against the sides. In short order he was lying on the ground, gasping for breath, with the mummy at his side.

As I examined the area where the outer cloth had been burned, the odor of charred flesh was still strong. Silver shawl pins securing the garment was a sure sign that the child was a girl. Unexpectedly, the cloth was loose, and as I drew it back, I was stunned to be staring directly into the face of a girl perhaps eight years old. After I got over the initial shock, I had mixed feelings. I was saddened by her expression, a look that still seemed expectant, yet I was pleased that the lightning hadn't destroyed her. The girl's left ear, shoulder, and part of her chest were badly charred, which made it seem all the more remarkable that the rest of her frozen body was still in excellent condition.

tucked into her clothes, as if she'd been cold.





Diving headlong into the dig, archaeology student Orlando Jaen is lowered to retrieve one of the mummies from an especially tight spot (left). The young girl had been hit by lightning and partly burned, but the team is amazed by the preservation of her face (center). Snow and insulating foam (right) keep the mummies from thawing before trucks with dry ice arrive to take them back to the city of Salta.

AMONG THE INCA, human sacrifices were rare and were intended as special offerings to the gods. Children were considered purer than adults; indeed a sacrificed child was believed to have been so honored as to have in effect become deified—a direct representative of the people, living with the gods forever after. Such children would themselves be worshiped from afar.

On Llullaillaco the sacrifices probably took place in December, during the South American summer, when temperatures were higher and there was less snow. The closest Inca administrative center of any importance was at Catarpe, near present-day San Pedro de Atacama, some 120 miles to the north in Chile. But the styles of the textiles, statues, and pottery indicate that they originated in Cuzco, Peru, about a thousand miles to the north. People living near Llullaillaco must have believed the mountains controlled weather as well as the fertility of animals and abundance of crops in the region—which is why people still worship the mountains today. The Inca authorities in Cuzco—the seat of the empire—knew that making offerings on sacred mountains was a way to incorporate those deities into the state religion, giving themselves greater control over the outlying people they subjugated.

Accounts written after the Spanish conquest describe months-long pilgrimages and even name the sacrificial children. In some cases a child was offered by his parents, who may have accompanied him on the journey. Local people would also assist the priests in ceremonies, perhaps with religious dances and drinking, until the procession reached its destination.

More ceremonies would have attended the long climb to the summit, which may have taken three days. Inca sacrifices reportedly died by being buried alive, by strangulation, or by a blow to the head—which is how the Ice Maiden died. The Llullaillaco children, however, have benign expressions and bear no obvious physical scars, suggesting that they died while unconscious or semiconscious, probably stupefied by a combination of ritual alcoholic drinks and altitude.

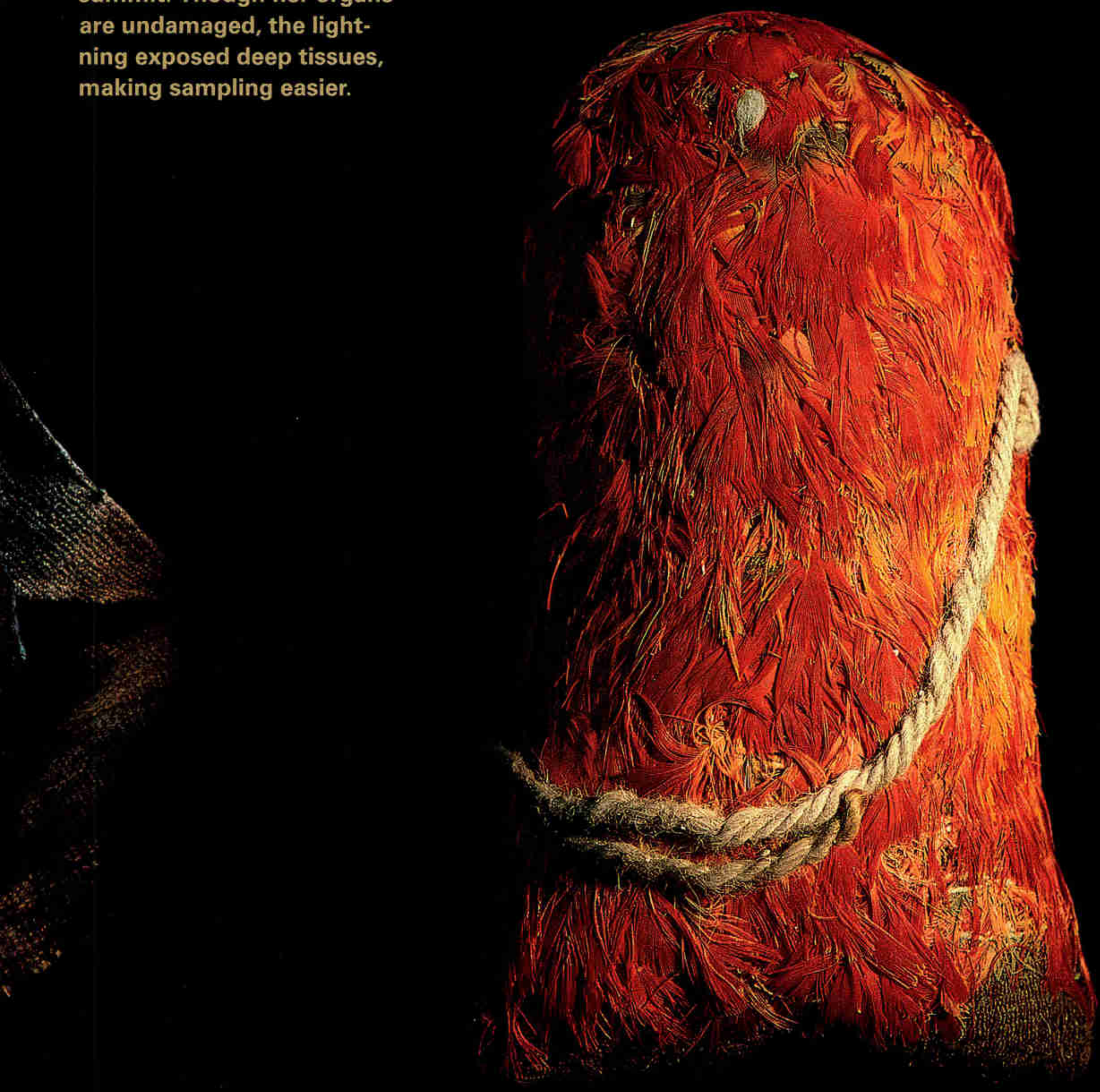
After two weeks on the summit the altitude was wearing us down, and provisions were running low, but we had accomplished everything I'd hoped to do. After we had filled in the

Chosen One

She still smells of charred flesh from the lightning strike that marred her ear, shoulder, and chest, but the rest of the young girl's body is in excellent condition. "A special blessing," says archaeologist Constanza Ceruti, the expedition's deputy director, because the strike loosened the textiles and made it possible to see the girl's face on the summit. Though her organs are undamaged, the lightning exposed deep tissues, making sampling easier.

Extracting the two dozen artifacts found near the body was tough work in the cramped grave; the position of each piece had to be meticulously recorded. "Digging takes a titanic effort, but even taking notes is hard at 22,000 feet," Ceruti says. "But it's important because for the Inca there was a lot of symbolism in the way they arranged offerings."

Among the artifacts were statues, pottery, food bags, and this coca bag made with feathers, perhaps from Amazonian birds. Coca was sacred for the Inca, and Andean people still use it regularly in offerings.



last of the excavations and gathered our tools, the wind dropped, and the Andes treated us to one of the most beautiful sunsets imaginable. I had arranged for dry ice to be brought to the mountain base to keep the mummies frozen on the two-day trip to Catholic University. There, Juan Carlos Romero, the governor of Salta Province, and Antonio Lovaglio, the minister of education and culture, made sure that we had the necessary materials to preserve the mummies in a temporary laboratory.

FULL ANALYSIS of the bodies and the textiles and artifacts associated with them will take years, but some findings are already in. CT scans of the bodies showed that their organs are nearly perfect. They also appear to have a large quantity of blood frozen in them, which is likely a first. "It opens up a whole new window of research," says Arthur Aufderheide of the University of Minnesota School of Medicine in Duluth. "We can search for antibodies that would indicate which diseases infected the children." By teaching us how some diseases have developed over the centuries, this knowledge may even help combat diseases today.

To test the children's DNA, we took tissue samples by needle biopsies. "The mitochondrial DNA couldn't be better," says Keith McKenney of the Institute for Biosciences at George Mason University in Virginia. "What we know for now is that they were not siblings or closely related on the maternal side." Their mitochondrial DNA sequences make it possible to identify modern-day relatives.

When I examined the younger girl, whose face and charred shoulder had become engraved in my mind, I saw details I'd missed in the emotional moments on the summit. Two braids were parted on either side of her face. Her mouth was slightly open, exposing her teeth, and her hands and feet were tucked into her clothes, as if she had been cold. Along with the two other children sacrificed on Llullaillaco, this gentle Inca girl has given us a rare opportunity to deepen our understanding of the lives and times of her people. Scientists from numerous fields have yet to begin their studies, and eventually I hope to report again on these extraordinary discoveries.

For an online Andes expedition with Johan Reinhard go to *www.nationalgeographic.com/andes.*



Inca Key

For the Inca, textiles were a highly prized art, an honorable gift, and an essential element of sacrifices. This tunic, found draped over the older girl's shoulder, took months to make. An interlocked tapestry with a design called Inca key, the tunic was worn only by nobility and was likely intended as a gift for the mountain deities. One of the best preserved of its kind, the tunic is cleaned by conservators in Salta with delicate brushes, tweezers, and vacuums (below).

With no written language, the Inca used textiles to record information. Clothing revealed where people were from and where they stood in society. Unfortunately the elaborate codes contained in the patterns may never be fully understood.



Artifacts of Empire

The author's newest discovery increased by half the world's known collection of clothed Inca statues. Twenty clothed and 16 unclothed statues were found, plus dozens of other artifacts. The costumed statue at right, probably made in Cuzco, is identical to ones found in other parts of the continent. "I'm always stunned by the Inca Empire's vast reach," says Inca textile expert William Conklin. "One rarely finds anything in the world of archaeology that is stamped out from one site like that."

The sandals above, found with the boy, may not have been Inca-made and might someday shed light on his origins. The rope sling was used with rocks for hunting and fighting. The pot below may contain food or *chicha* (corn beer). Eventually the stopper will be removed and the contents examined.



Go Gently

Faces of the dead can hold grimaces of pain, but the teenage girl wears a placid expression. Before death, all three children were probably unconscious from a combination of altitude and chicha—part of the plan, it seems, to send them into the next world undistressed. The children died expecting immortality, and in a sense they got it: With their organs and blood frozen in place, their DNA has survived unscathed and may point scientists to their present-day relatives. □

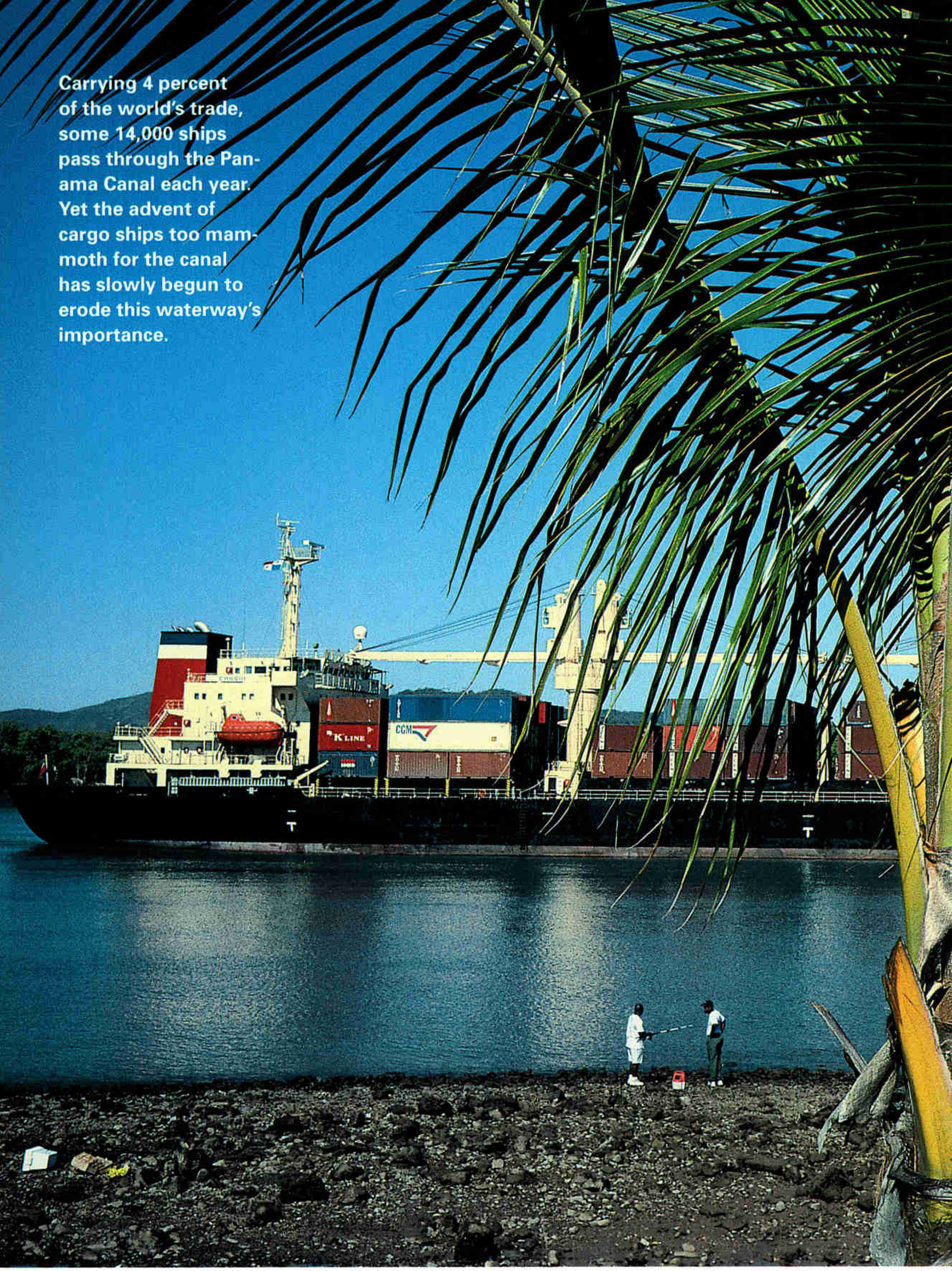



Preparing to sail solo, Panamanians will assume full responsibility for their famed canal at noon on December 31, 1999. After 85 years of United States stewardship, the *yanquis* are finally going home.

Panama's Rite of Passage

BY LEWIS M. SIMONS

PHOTOGRAPHS BY ALEX WEBB


Carrying 4 percent of the world's trade, some 14,000 ships pass through the Panama Canal each year. Yet the advent of cargo ships too mammoth for the canal has slowly begun to erode this waterway's importance.
K LINE
CGM



The plum jobs...

were—and will remain—
on the canal itself.

Sacking out till the next customer arrives, a vendor at the Ancón fruit and vegetable market takes an impromptu siesta. "But there's no real siesta in Panama City now," says one native. "To be competitive, you gotta keep going."

People here have never
learned to
feel independent.

The first two fingers of his right hand wrapped tight in a thin cotton rag, Alfonso Gonzalez Sanchez works the wax in tiny overlapping circles, coaxing the toe of the black leather combat boot he holds across his knees to a brilliant gloss. From time to time he dips the cloth into an old polish tin of water: the technique of the classic military spit shine. Around him, as he sits in the shade cast by a precise column of royal palms, are arrayed the 23 pairs of identical boots that are the day's work ahead. Some are caked with dried mud and will require a thorough scrubbing before he can begin rubbing them to inspection standard.

There is harder, dirtier work, certainly, but polishing the boots of foreign soldiers occupying your country is not something most of us willingly would choose to do. Yet Gonzalez is delighted to have this job, serving the officers and men of Building 127, Theater Support Brigade, Fort Clayton, Panama, U.S. Army South. But he's also sick with worry, knowing that come the end of the year, they'll leave and with them his livelihood of 21 years.

Gonzalez is 55 years old and lives in a small wooden house with his wife, their seven children, and her stepfather. No longer up to heavy lifting, he sees no future other than rolling a pushcart out into the narrow streets of Casco Viejo, the old quarter of Panama City, trying to sell inexpensive items to passersby: dish towels, maybe razor blades, hair ornaments—or shoelaces. No matter what new occupation he undertakes, he knows that nothing will pay nearly as well as boot polishing for the GIs. At Fort Clayton he earns between $250 and $300 a month for helping the soldiers look sharp. As a onetime net hauler aboard a shrimp boat, he knows that manual laborers in Panama are lucky to get six or seven dollars a day, less than half what the Americans pay him.

"Every day I pray to God that the gringo doesn't leave," Gonzalez tells me as he takes a short break, wiping sweat from his forehead with the back of a polish-blackened hand. "All my life I thought the Americans would never go. And until I see them get on their airplane and fly away, I'll continue to believe this." Then he glances down at his own shoes, once white sneakers, the backs squashed flat for ease of entry and egress. He shakes his head slowly, grudgingly acknowledging the reality: "It's very bad for our country that they're going; the biggest mistake Panama has ever made."



LEWIS M. SIMONS is an award-winning foreign correspondent whose work over 30 years has spanned the Asian continent. This was his first assignment in Latin America. Photographer ALEX WEBB, who has worked extensively in the region, contributed to our special issue on Mexico in August 1996.



Want to do business in Panama City? Club membership can help seal a deal. At Club Ejecutivo, a golf and social club that hosts the occasional wedding reception (left), you'll find entrepreneurs, merchants, the newer money. Old, established families congregate at Club Union, while boating enthusiasts head to the Club de Yates y Pesca (above, at bottom left). Class and racial divisions persist among the city's many clubs, as they do in much of the world.

At noon on the final day of 1999 the United States will ceremonially hand the government of Panama the monumental canal, which was created by American ingenuity (U.S. engineers commanded nearly 75,000 workers from around the world in the ten years of construction), fortune (387 million dollars), grit, sweat—and connivance—at the outset of a century Americans now claim as their own. The last of some 7,000 U.S. military and civilian buildings in the former Panama Canal Zone, a ten-mile-wide strip of land bracketing the waterway along its entire 50-mile length, also will be turned over. And the last American soldier will leave.

At the peak during World War II the U.S. had 60,000 troops in Panama. Even a decade ago 11,000 U.S. soldiers were stationed there, and the military pumped 350 million dollars into the country's economy each year. The U.S. forces directly employed 2,800 local civilians in a variety of jobs, ranging from clerks to plumbers. Since the "zone" was always run as an outpost of the U.S., Panamanians who got these prized jobs were paid almost at U.S. levels. This created anomalies: Bookkeepers for the U.S. Army earned as much as executives in Panamanian corporations, clerks as much as doctors. The plum jobs, however, were—and will remain—on the canal itself, and by the end of this year the 9,000-member workforce will be almost entirely Panamanian.

Alfonso Gonzalez isn't alone in wishing the full U.S. presence would continue, or in his gloomy outlook. As many as 78 percent of the country's 2.8 million people, according to a 1996 poll, hope the gringos won't go. And like Gonzalez, they anticipate bleak times ahead as the final phase of treaties worked out between Panama and the U.S. in 1977 kicks in. Those

agreements, negotiated by then presidents Jimmy Carter and Omar Torrijos, resulted in the shutting down of the U.S. military apparatus and the controversial "reflagging" of the canal from the United States to Panama.

Although Panama has existed as a country since 1903, the U.S. involvement has been so overwhelming that people here have never learned to feel independent. Now, for the first time since Theodore Roosevelt used gunboat diplomacy to wrest the Isthmus of Panama from Colombia and create a special-purpose state where the United States could build and run the canal, Panamanians are on their own.

"We're like the little boy in short pants who's always run to daddy when he's gotten into trouble," said Roberto Brenes, an economist and banker in Panama City. "Now, daddy's gone, and the little boy must put on his first pair of long trousers."

Naturally, not everyone will miss the Americans. At a demonstration near the University of Panama, protesting a government plan to turn Panama City's water department over to private management, a graduate student in biology buttonholed me. "It's long past due that your country leaves us alone. Colonialism is out of fashion, you know."

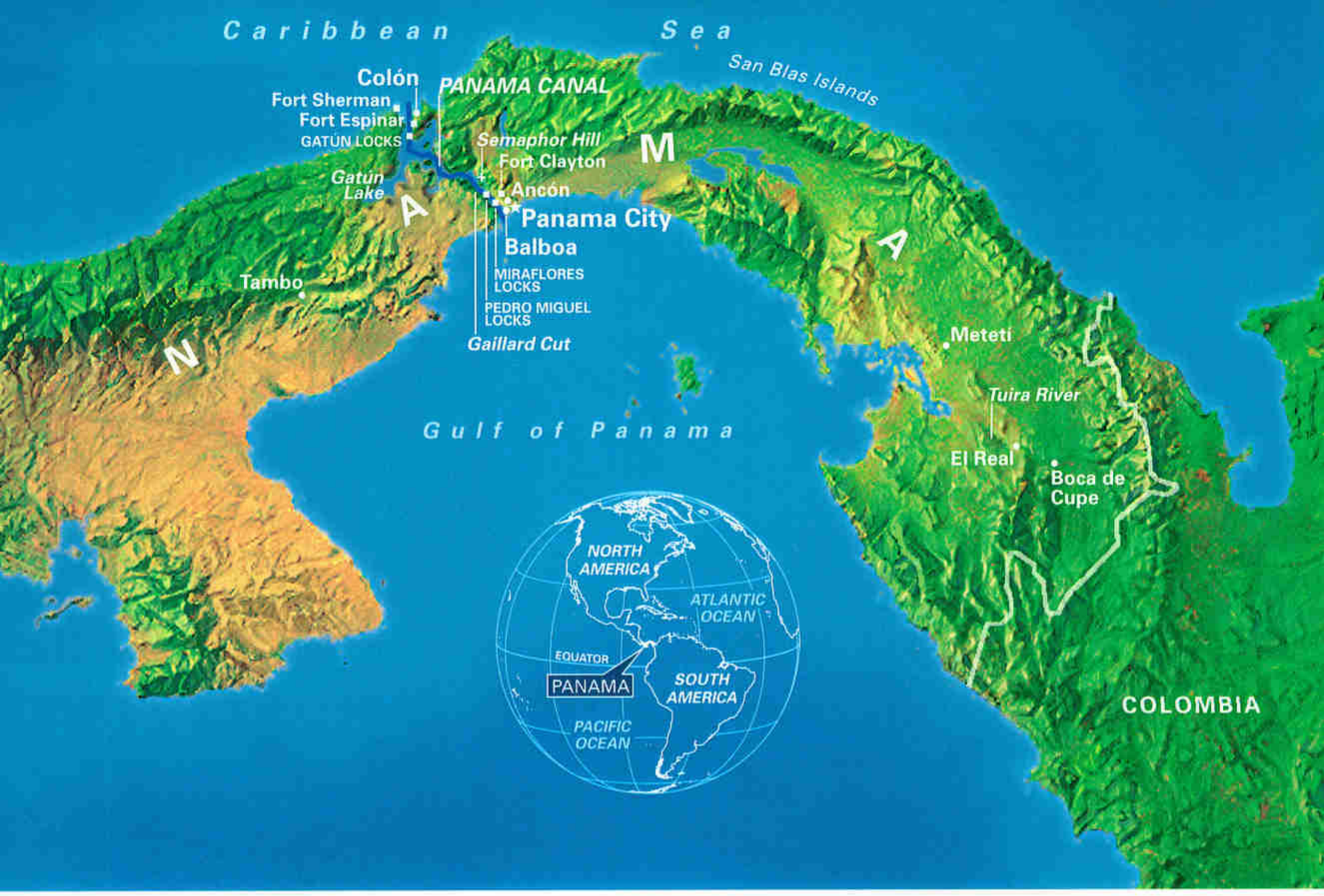
Of all the uncertainties ahead, the one most on people's minds is what will happen to the canal and the facilities in the Canal Zone. Although of little military use today, the canal is still vital to international shipping, cutting the distance between, say, Tokyo and London by 4,500 miles. Every year 14,000 ships pass through it, carrying more than 4 percent of the world's trade.





At the granite, colonial-era administration building above Balboa, on a tree-covered hilltop at the Pacific end of the waterway, I called on Alberto Aleman Zubieta, the canal's third Panamanian administrator. Youthful and casual, Aleman suggested that when it comes to the day-to-day running of the canal, Panamanians have already overcome their dependence on the U.S. We spoke in the airy, mahogany-furnished office that goes with the top job, its sea green walls lined with historic oils of the waterway and its ships. "Jobs on the canal are highly prized in our society," he said. "By filling every position with only the most qualified people, we're assuring a seamless transition from a U.S. to a Panamanian canal."

For a look at how the transition was going, well before dawn one morning I drove an hour and a half from Panama City to the northern end of Gatún Lake, at the approach to one of the canal's three sets of locks. When filled with or emptied of water—52 million gallons each,



If building the Panama Canal was a Herculean feat, its impact on trade was equally Olympian. Once the U.S. opened the Big Ditch in 1914, ships sailing from New York to San Francisco could chop 9,000 miles off the journey by using the canal (left) instead of rounding South America. The big job these days is managerial. Some observers fear that the Panamanian government will use canal revenues for pet projects instead of keeping the waterway shipshape.

enough to meet the daily needs of a city the size of Detroit—these mammoth concrete-and-steel boxes raise and lower ships 85 feet to cross the Continental Divide.

The rising sun brought an instant steam bath, but canal workers seemed impervious, neatly dressed and attentive to their duties. The more-or-less natural surroundings of the man-made lake, with its jungled shores and tiny green islets—in fact, flooded hilltops—give way to the locks' concrete walls, topped by stubby, powerful electric locomotives that guide the ships through the passageways.

At Gatún Locks I was taken out into the navigation channel by motor launch to a rust-streaked blue-and-white car carrier, the *Southern Ace*, owned by Japan's Mitsui Corporation. There was nothing graceful, or even shiplike, about *Southern Ace*. More than 620 feet long and as high as a five-story building, it was simply a floating parking lot capable of hauling nearly 6,000 automobiles. On this voyage, from Bremerhaven to Los Angeles, *Southern Ace* was carrying 1,288 Mercedes-Benzes and Volkswagens. A fragile-looking Jacob's ladder of wooden slats linked by knotted ropes was dropped over the side, and I climbed it, gingerly, up to the deck.

On the glassed-in bridge I met Edgar Tejada, the pilot who had just brought the ship through the locks and now would guide it across Gatún Lake and through the Miraflores and Pedro Miguel Locks to the Pacific. Tejada, 45, has been a pilot—the elite of the Panama Canal workforce—since 1984. Before that he was the master of a canal-going tug. He performs his task pretty much as it's been done since the first ship, the *Ancón*, crossed from the Atlantic to the Pacific in August 1914: by

Playing devil's advocate, kids show off their masks in Colón's La Playita neighborhood a few days before Carnival. In this slum, riddled with unemployment, drugs, and crime, the devil gets his due the rest of the year too.



as well as boot polishing
for the GIs.



eyeball, feel, and instinct as well as experience.

"The canal is so short, with great variables in tides on the Pacific side and with so many narrow twists and turns, such sudden changes in weather and wind, that if I look away for even three seconds, we could be out of the channel and on a sandbar," Tejada said. For their expertise, Panama Canal pilots are paid $80,000 to $150,000 a year, comparable to airline pilots in the U.S.

Seated at barstool level, peering through well-worn binoculars, Tejada ordered the young Filipino navigator to proceed at ten knots. Approaching a bend, he called "one-two-three," and the navigator turned the ship to 123 degrees on the wall-mounted gyrocompass. In ragged succession, ships passed us heading in the opposite direction. The swell and suction created between ships occasionally causes a foul-up. Only a week earlier, Tejada said, a container ship had run aground near where we were, costing its owners six days of downtime while it was refloated.

As we cleared Gaillard Cut, a landslide-prone strip notorious for breaking spirits during what the Americans called simply "the work," a shrill whistle sounded in the distance, and the air reverberated with the blast of dynamite.

Larger than life, a mural in Panama City reflects a small part of the cultural legacy of the United States, where volleyball first got rolling. Another U.S. legacy is the huge inventory of military facilities, including an old radar station on Semaphor Hill (right). Once used to help intercept planes carrying drug smugglers from South America, the building was recently converted into the Canopy Tower—a rain forest roost for birders and other ecotourists.

Perhaps no other place along the canal so graphically illustrates the struggle between the men who dug it and the land they were taming. The cut runs for more than eight miles through rock and shale, the very core of the Continental Divide. What you don't see as you cruise past its black, steeply sloped wall is the 48-foot depth beneath the surface of the water. Again and again as this channel was dug, earth slides buried men and machines, stalling progress.

Now the Gaillard Cut is being broadened and deepened as part of a one-billion-dollar

improvement on the eve of the handover. These improvements will clear a canal bottleneck, enabling two-way traffic for larger vessels within the cut for the first time.

"We've always dreamed of having everything under our flag," said Tejada. "Now we'll have to do everything right, and that will help the national spirit." He broke off our conversation to call a new direction to the navigator. But his burst of patriotic optimism was at odds with the worries so many others had expressed.

A nervous start is understandable, according to Ambler Moss, a former U.S. ambassador to Panama and now the director of the North-South Center at the University of Miami in Coral Gables. "Too many things are happening at once—they're taking charge of the canal; they're trying to convert the bases; the troops are leaving; they're getting a new president. But," he said, "Panama has less reason to worry than the Philippines did. It's close to the U.S. The U.S. needs the canal. Other countries, especially in Europe and Asia, need the canal too, and they want to invest."



Meanwhile Panamanians are putting their stamp on the canal and its surroundings. Some of the buildings that used to house American civilian and military personnel in tropical suburban comfort have already been sold to local families. They're moving in, adding decorative touches like faux pillars, religious statuary, and yellows, greens, and hot Caribbean pinks over the government-issue white walls.

Albrook Air Force Base is now Panama City's domestic airport, and work is under way on a number of other ambitious projects. At Fort Espinar, near the Caribbean end of the canal, the once infamous School of the Americas—where, judging by Defense Department training manuals, U.S. experts tutored a generation of Latin American dictators in the arts of torture, interrogation, and other necessities of retaining power—is being rebuilt as a luxury hotel and conference center. Fort Clayton, with its rolling lawns and red-tile-roofed buildings, will become an education and technology center called the City of Knowledge.

BACK ON THE BRIDGE of the *Southern Ace*, Tejada and I resumed our discussion, but the direction of his thoughts had shifted. "In theory the new national law adopted by the government to operate the canal totally isolates it from politics. But in Panama the politicians always have a way of misconstruing laws so that they work out to someone's personal benefit. That's the problem in Panama."

Like Tejada, some Panamanians anticipate that once the handover is completed and the Americans have gone home, politicians will dip into the lucrative canal as if it were their private piñata, loaded with goodies. A leading critic is Maylin Correa, the outspoken and popular mayor of Panama City from 1991 until early this year. Over lunch at her spacious but simply furnished office in City Hall, a grime-encrusted building at the edge of the capital's old quarter, she claimed that while 5,000 jobs are being lost, the national government "is putting Panama up for sale." What Correa meant was that assets from the canal were already being siphoned off to those close to the outgoing president, Ernesto Pérez Balladares. "The people are not benefiting," she said.

Balladares, whose term ended in August, was reviled in the local press, particularly the widely read *La Prensa*, as well as by his political opponents, for appointing relatives and friends to the canal board of directors. In a lengthy conversation while he was making an



out-of-town helicopter trip, he laughed dismissively when I asked him about the claims. "I've chosen those with the best capabilities, and I'd choose the same ones all over again."

The new president is Mireya Moscoso, widow of Arnulfo Arias—three times elected president and three times overthrown by the army—and the first woman to lead Panama. On the eve of her victory in May, Moscoso promised to replace Balladares's appointees as soon as their terms expire, some next year. "We need to tell the world we are prepared to manage the canal as well as the United States," she said.

Certainly the workers who run the canal are doing things well. As the *Southern Ace* steamed toward the Pedro Miguel Locks—where there's a red-and-blue billboard with the words "Providing Passage Into the 21st Century"—a launch approached, and a team of line handlers boarded. They had the tricky task of throwing well-aimed ropes to the locomotives, which steadied us into the lock with cables. The exquisitely balanced gates swung shut behind us, and gravity went to work, flushing water out and lowering us 30 feet. So controlled was the operation that the only awareness I had of changing levels came from watching the watermarks on the gray concrete walls of the lock. Out of Pedro Miguel, we proceeded again at a stately pace.

At Miraflores Locks, rather than continuing for the rest of the 14-hour transit, I clambered back down the ladder to a launch and waved good-bye to Edgar Tejada. His skill in directing



Grab a chair in the dining room of the Canopy Tower, 40 feet above the rain forest floor, dig into dinner, and enjoy the wild show outside—white-faced capuchins and howler monkeys, black-breasted puffbirds, keel-billed toucans. "I love nature, and here I'm completely surrounded by it," says owner Raúl Arias de Para, who calls the former radar station "the ultimate recycled product."

the *Southern Ace* seemed to confirm former Ambassador Moss's optimism. It struck me that the transformation to self-reliance may depend less on Panamanians acquiring expertise than on their ability to stop thinking of themselves only as little brothers—of America for the past century, of Colombia before that, and, earlier still, of Spain.

EVER SINCE the Isthmus of Panama became a stone-paved pathway for gold- and silver-laden Spanish mule trains five centuries ago, the region has attracted people on the make. Today Panama City's shoreline prickles with tinted-glass towers housing 104 international banks. They're here in part because of loose banking rules, which allow Latin American drug traffickers to launder their millions, but also because Panama's currency is the U.S. dollar (and will remain so), which helps protect the economy from high rates of inflation.

If Panama has drawn more than its share of adventurers, pirates, con artists, and other scalawags, this same dubious distinction has made it one of the most cosmopolitan centers in the world. Large numbers of Chinese and Indians, Arabs and Jews, Europeans and West Indians have come in, some legally, others not, set up shop, and assimilated to one degree or another.

But even in Panama there are limits to tolerance. Some of the wealthiest white families, most of whom are of Spanish heritage and nearly all of whom are members of the plush and exclusionary Club Union, built into the bayside a few blocks from the new synagogue, do not welcome the dark-skinned, the Muslim, or, with a few exceptions, the Jewish, however wealthy they might be. Inordinately proud of their fair complexions, these Panamanians are called, with a mixture of envy and derision, *rabiblancos,* white tails.

On Super Bowl Sunday I joined a standing-room-only crowd of them (plus a handful of resident gringos) at Bennigan's, the trendiest spot in town. Some of the Panamanians actually watched the game, but most were making the rounds, air kissing and drinking Budweiser. When I asked a statuesque blonde in breath-takingly tight jeans and T-shirt why there were no blacks in the crowd, she immediately countered, in unaccented English, "Would it be any different in Miami or L.A.?"

Life for the rabiblancos includes weekend shopping jaunts to Miami, second homes in Boca Raton, and kids jetting off to Notre Dame and Boston College. In all likelihood it does not include visiting Darién Province, Panama's poorest region, on the border with Colombia just a few hours' drive from Panama City.

Nor, until recently, did the government pay much attention to Darién, which has no more than 50,000 small farmers and indigenous people. As a result Colombian guerrillas fighting the government in their country, as well as cocaine "mules" and other Colombian outlaws, have taken to slipping across the unguarded border and using Darién as a refuge and a place from which to steal food, cash, and weapons.

Run-down bayside real estate in Panama City's El Terraplén section will soon feature cafés, boutiques, latte shops, and the like. It's a bright bit of urban renewal in a nation where nearly 40 percent of the people live below the poverty line.





"I'm afraid there's going to be a lot of unemployment."

—ARACELYS BETHANCOURT, PANAMA CITY

Occasionally the Colombians make armed attacks on villages. In 1997 they killed two civilians and a policeman, wounded two other policemen, and kidnapped a civilian in the riverside town of Boca de Cupe.

"It has always been a marginal zone, very poor, and this has created an environment for crime and unrest," said Clovis Sinistera, the province's U.S.- and French-trained police commissioner. I met him in Metetí, the sleepy provincial seat in central Darién. "We're trying to hold the peace in a difficult situation, in which the Colombian government has problems with thugs and guerrillas, and they spill over here."

PEOPLE IN METETÍ, and practically everywhere else I traveled in the country, share the anxiety that once the U.S. military presence is removed, Panama—which has a 16,000-member police force but no longer an army of its own—will be even more vulnerable to Colombian drug runners and insurgents.

Monsignor Romulo Emiliani, the Catholic bishop of Darién, takes the province's security as a personal challenge. Following a drum-thumping, hand-clapping folkloric Mass at his simple concrete-block church in Metetí one Sunday, Emiliani—a hearty, ruddy-faced man of 50 with a boisterous laugh—told me that in the past year increased financing by the central government and tougher training have produced "acceptable" police control in the area. Darién, he said, was in a watch-and-wait mode. "We need more and better police security to take care of a Panama without the U.S. If not, Panama will never become a truly sovereign country."

With a small group in a pencil-thin pirogue, I made a journey up the Tuira River into the heart of Darién. We started from the town of El Real, ringed by jungle, where there were signs of stepped-up security. Lt. Roberto Lewis, the ranking police officer, was supervising a dozen men uniformed in black shorts and T-shirts, sweat-soaked in the spongy heat, as they unloaded concrete blocks from a barge. They were to be sent on a smaller boat to Boca de Cupe, to build a police station. "This will help expand our network, which used to stop at El Real," Lewis said.

Francisco Mepaquito, our stocky Wounaan helmsman and guide, carved slalom-like turns through the shallow, winding Tuira. With us was Tonny Membora, also a Wounaan, who was on a buying trip for the exquisitely handcrafted baskets he sells in Panama City.

In Darién the 2,000 Wounaan, along with the 12,000 members of the Emberá group, are the surviving descendants of Amerindian peoples decimated by the conquistadores. Of late, the two native minorities have begun trying to overcome cultural differences in hopes of gaining some of the political clout of the more numerous Cuna, concentrated in the San Blas Islands. Panama's other indigenous people, the Ngobe-Bugle, scrape by picking coffee beans in the hills along the Panama–Costa Rica frontier.



After three hours we reached Boca de Cupe, a village of 900 people, mainly descendants of African slaves who escaped the Spanish conquistadores. The village was guarded by 35 policemen wearing camouflage and dug into sandbagged bunkers protected by Czech-made machine guns. Their officer, Lt. Oscar Eraso, said that when the new police station is built, there will be a hundred men here. A few weeks before I arrived, he said, nearly 150 Colombian guerrillas had taken over a nearby village, remaining there for about ten days before going



Armed for a bath: Thousands of border policemen, including this patrol heading to a river in Boca de Cupe, were recently dispatched to Darién Province to help deter violent incursions by leftist guerrillas from neighboring Colombia. At Fort Sherman, soldiers sweat at what was the U.S. military's only jungle warfare training facility (left). Since the fort reverted to Panamanian control, Pentagon officials have sought a suitable replacement, in vain.

back across the border. "This area is convenient for them, and they were just resting, not causing any trouble. We didn't attack—generally we don't—because if they knew we knew they were there, they would kill our informer."

Eraso, tall and broad-shouldered, had made friends among the people in the isolated village under his protection. We bought orange sodas at a tiny store owned by Aleida Ramos, whose husband, Antonio, had been kidnapped by Colombians in August 1996. They held him for nine months, until she was able to raise the $50,000 ransom from her extended family and the rest of the village, where the average annual income is about $80. "Things are better now," said Mrs. Ramos, as she rocked in a straight-backed chair on her shop's front porch. "But I'm still afraid of the guerrillas. You never know when they may come back and kidnap you, or worse."

We left Boca de Cupe and motored a few more miles upriver to the Wounaan village of Capetuira—Francisco's home—where we spent the night. Like Boca de Cupe and most other riverside settlements Capetuira was guarded by heavily armed police holed up in a hillside bunker with clear views of the large, open-sided huts and the river beyond. The government had recently brought electricity to the town and put in two concrete sidewalks, but there was no avoiding the poverty.

In the morning I climbed a notched log to Francisco's stilt house. His four-year-old daughter, Gricelda, was sitting on the springy, split-bamboo floor. When I held out my arms to her, she burst into loud wailing. Francisco scooped her up, explaining that Gricelda had been born with twisted legs and couldn't walk or crawl. Visiting paramedics lacked the knowledge to help, and the family couldn't

Matadors for a minute or two, spectators at a fair in Tambo are invited to put down their drinks and jump into the ring. The bulls here aren't bred for fighting, but during these days of transition in Panama, flexibility is an asset.



while it
lasted."

—DENISE WILL, CANAL ZONE



afford to travel to Panama City for qualified medical care.

FOR PEOPLE as poor as Francisco Mepaquito, these twilight days of the American presence bring the worry that they will grow only poorer in the years ahead. The rush of *soberania,* sovereignty fever, that greeted the Torrijos triumph—Panama even named a national park and a beer for the newfound emotion—is long gone.

Back in Panama City I wandered along Calle 27, a street of grimy concrete tenements in El Chorrillo, one of the capital's poorest, most crime-ridden neighborhoods. It was Sunday afternoon, and residents were out in crowds, gossiping, laughing, snacking on fried plantains, drinking beer, betting on televised horse races, flicking their hips to blaring Caribbean tunes. El Chorrillo was ground zero when invading U.S. forces attacked the city just before Christmas 1989, eventually seizing Gen. Manuel Noriega, whose command center was located there. Noriega had been a longtime CIA and DEA anti-narcotics and anti-Marxist informant, but his blatant corruption had become an embarrassment.

When I stopped to speak with a group of women chatting beneath a broad red-and-green-striped umbrella, they were more concerned about the impending departure than bitter about the past. "It's not an easy matter to discuss," said Aracelys Bethancourt, a



"America is a large, friendly dog in a very small room," historian Arnold Toynbee once observed. "Every time it wags its tail it knocks over a chair." Soon Panama, from Bocas del Toro (left) in the west to the wilds of Darién in the east, will be free of American forces. But a bilateral treaty states that if the canal's security is threatened, the U.S. will return, teeth bared.

30-year-old mother of two, wearing a red tank top and yellow shorts. "Sovereignty is important, it's true, because it means we're free to express ourselves and to do as we like in our own country. But I don't trust our politicians. I'm afraid there's going to be a lot of unemployment and poverty."

She said that her husband, a housepainter, considers himself lucky during weeks in which he makes $60. He doesn't receive any social security or insurance benefits. To supplement his income, Bethancourt sells paper plates of fried chicken and beet-dyed potato salad, a dollar apiece, from a small table under the umbrella. "Most of the men in this neighborhood work for the Americans," Bethancourt said, "and they earn five dollars or even seven dollars an hour plus benefits."

So, while she and her family eke out a life at just above the poverty level, their neighbors doing manual labor on the U.S. payroll have been earning at least four times as much.

Americans in Panama, whether they're in the armed forces or work for the canal, say they, too, regret having to go. Robert Will, 51, was born in the Canal Zone, a third-generation "Zonian." His grandfather was a pilot, his father a tug captain, and he's a tonnage surveyor, assessing ships' weights to determine their tolls. Except for two years in college and a year in Vietnam, Robert has lived all his life in the Canal Zone. His wife, Denise, 43, came from Minneapolis in 1967 with her parents—her father supervised the locks—and she, too, works for the canal, compiling a history of the U.S. presence.

The Wills and their two young children have lived comfortably—and, as do all Zonians, rent free—in a village near Ancón. It's a tidy, all-American neighborhood of white bungalows and town houses on neatly clipped lawns and looks as if it has been lifted out of a South Florida subdivision and set down alongside the canal—inflated play pools, sport-utility vehicles with pleasure boats in tow, and all.

"Growing up here was just like small-town U.S.A.," Robert said, as we sat in their living room surrounded by packing cases. "The only difference was, I'd come home from school and wham! right out into the jungle: building forts, catching butterflies, fishing for tarpon, hitting the beaches. We played basketball, baseball, and football, just like in the States." Denise remembered being surprised when she first noticed that people didn't lock their cars or their houses. "Of course, that's changing now that we don't have our Canal Zone police anymore."

The Wills have decided to move to Daytona Beach, a popular retreat for Americans leaving Panama, where the climate and pace of life are familiar. Robert said he could keep his job under the Panamanians, but it would mean losing their 15 percent "tropical differential" and their annual five weeks of paid home leave. "You could say we were coddled, I suppose, but that's always been the system," he explained. Denise looked up and smiled. "It was a great ride while it lasted," she said. □

With the new millennium, Panama will control the Canal Zone. Was the U.S. presence a boon or a bane? Comment online at *www.nationalgeographic.com/ngm/9911.*

African Marriage Rituals

ARTICLE AND PHOTOGRAPHS
BY Carol Beckwith
AND Angela Fisher

IT TOOK TEN YEARS

of crisscrossing Africa by four-wheel drive, camel, and mule train for the authors to chronicle the rituals shown here. Traditional weddings are fading across the continent in the wake of modern culture, yet those remaining constitute some of the finest examples of these age-old ceremonies.



A veil of gold cannot hide the beauty of an Afar sultan's daughter in Djibouti. Even among families of modest means, traditional African marriages can be elaborate celebrations that last for days.



Berber

In Morocco's High Atlas mountains virgins like 12-year-old H'dda (below left) may catch the eye of a suitor at the annual brides' fair in the village of Imilchil. If her parents approve, a prolonged courtship begins. Under Moroccan law girls cannot marry until 16, but many Berbers keep their own counsel. For widows and divorced women the Imilchil fair is an open market, with marriages sealed on the spot. Before a young bride's wedding her mother rubs her legs with henna, a ritual that her people,





the Ait Hadiddou, believe repels jinn, or evil spirits.

Conveying blessings and bittersweet good-byes, a mother plants a kiss on her daughter's knee (below) as she gives her in marriage to a man more than twice her age. After a time of seclusion following the ceremony, the girl will travel by mule to her husband's home. Once there, one of his female relatives lifts her off (left) so her feet don't touch the ground and risk evil spirits entering her body.

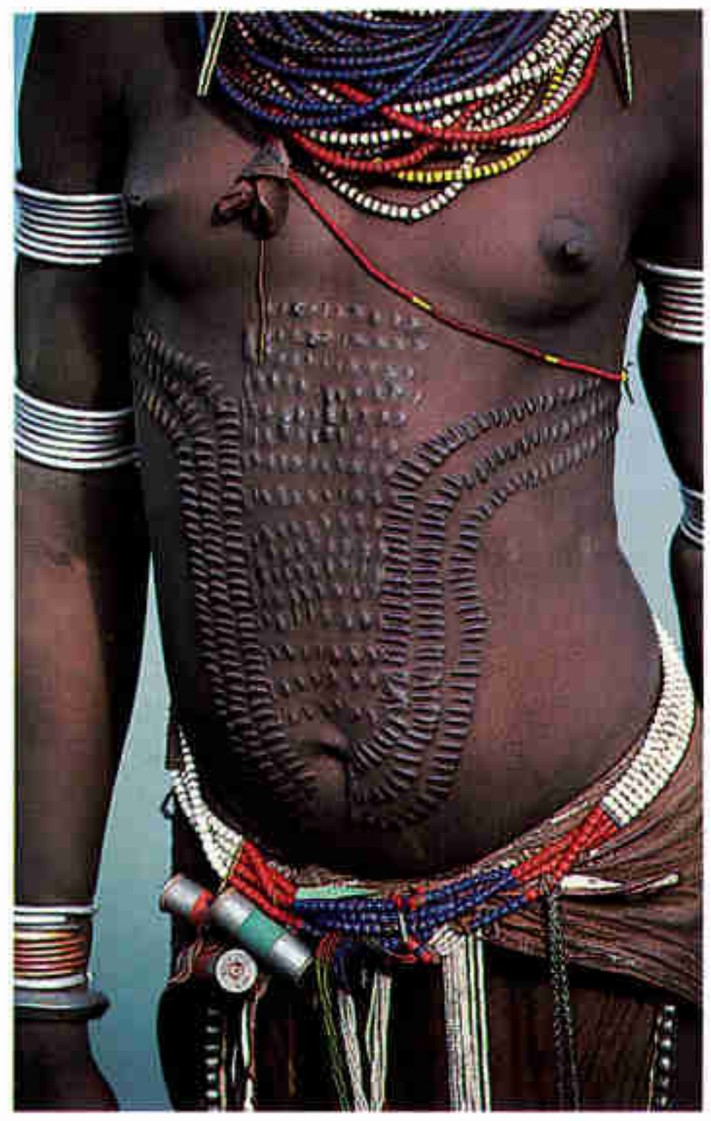


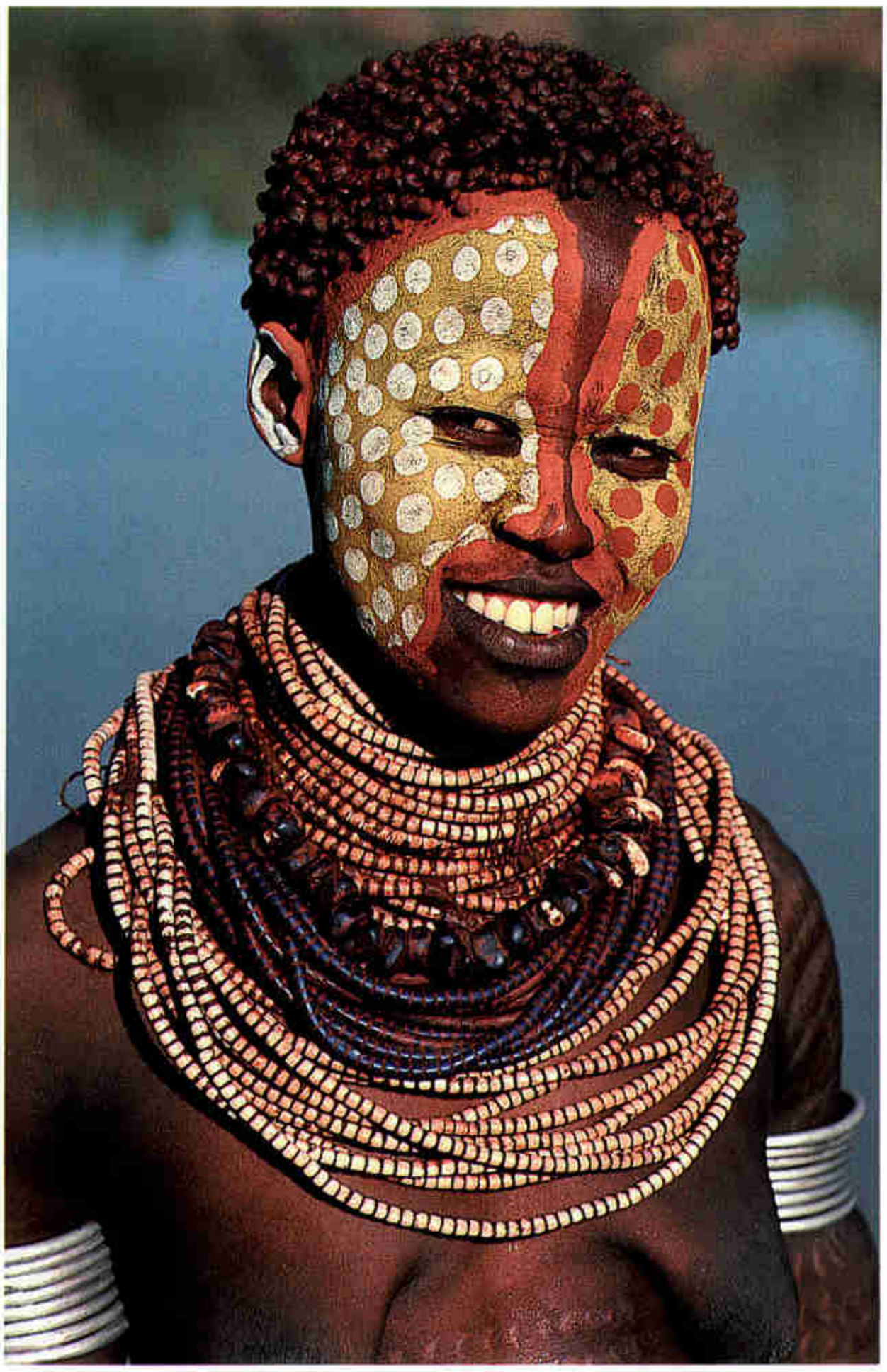
Days of feasting weave into nights of singing and dancing for the bride, who has captured the liver—the Berber embodiment of love—of the man sworn to protect her.



Karo

The beauty of Ethiopia's Omo River Valley is matched by its people, who decorate their bodies to enhance their looks and attract the opposite sex. The 500 or so Karo have little material wealth, so they rely on nature and trade for what they need to adorn themselves. When a Karo girl reaches puberty, she endures the pain of scarification as razorlike cuts are incised into the skin of her abdomen. Ashes rubbed into the wounds make them heal in an elaborate raised pattern (right). This, Karo men told us, increases her desirability.





Other cosmetic enticements glow from the face paint that a woman named Kawo has applied to herself (left). Imitating a guinea fowl's spotted plumage, her striking palette is made from pulverized iron ore, yellow rock, and white chalk. A string of black wild banana seeds sits atop lengths of Czech glass beads traded at a small market more than three days' walk away.

When the summer has passed and the harvest of beans, corn, and sorghum is complete, courtship season begins. The eligible Karo, turned out in all their splendor of paint, beadwork, and aluminum bracelets, join in exuberant dances (right). A man signals a partner by thrusting his hips her way. So begins an evening of rhythmic dancing and singing. For many the excitement will lead to betrothal, marriage, and a lifetime together.



Wodaabe

All eyes are on smiling Mobobo (below), who holds the hearts of her two suitors, who are cousins. Wearing their most potent talismans to enhance their charm, they vie for her attention. Only among the Wodaabe, nomadic pastoralists in the Sahel of Niger, have we seen such a custom: Male cousins about the same age, called *wal-deebe,* who share a special bond, sometimes also share affection for the same girl. If she marries one, the other is welcome in their home and, with her consent, in her bed.





Rules of social conduct are paramount to the Wodaabe, "people of the taboo." Their code of behavior emphasizes reserve and modesty—*semteende*—perfectly expressed in the demeanor of Mojendeybu (below) as she prepares to marry. In customary Wodaabe form, she averts her glance beneath a fringed veil.





Grand displays are in order during an annual festival called Worso, which celebrates the year's births. Women decorate beds given to them by their husbands after the birth of their first child. One woman (top) framed hers in plastic bits and streamers, silver thumbtacks, and beach balls. The women whose beds are judged best are honored with songs that enter Wodaabe oral history.

Swahili

Elevating a glance to an art form, Khadijah (below left) says with her eyes what Swahili women in Lamu, Kenya, are forbidden to say in words. Socially segregated by strict Islamic law, a woman shrouded in a black *bui-bui* may attract a man's attention when she appears in public with friends, but most marriages are arranged.

A Swahili wedding is filled with rituals designed to beautify the bride and heighten the senses. Several days before her marriage Fatima undergoes a series of treatments. All her body hair below the neck is removed. She is then massaged with coconut oil and perfumed with sandalwood. With twigs dipped in henna, women draw designs on her limbs (opposite). An older woman, called a *somo,* teaches Fatima how to please her husband, even, perhaps, waiting under their bed to assist in case the couple have difficulty consummating the marriage.



On the wedding day (below), the groom lifts the veil of his bride—whose face he may be seeing for the first time—and gives her a necklace of gold or coral. The partner whose hand ends up on top in the playful exchange is believed to have the upper hand in the marriage. The wedding is sealed in an all-male ceremony in a mosque.



Ndebele

While documenting the art of Ndebele housepainting, we learned of a wedding to take place in a family homestead north of Pretoria, South Africa, where the Ndzundza Ndebele raise cattle and grow corn and millet. Ndebele weddings are celebrated in three stages, which can take years to conclude. They begin with the negotiation of *lobola,* or bride price, paid in installments of money and livestock.



A two-week seclusion of the bride-to-be marks the second stage, when other women teach her how to be a good Ndebele wife.

Coming out of seclusion, Zanelle shows off the heavily beaded attire she wore for her initiation into womanhood a year or so before (opposite). Colorful beaded hoops called *golwani* encircle her waist and legs, imitating the voluptuous female form so admired by the Ndebele.

Later, in a show of shyness expected of Ndebele women, she stands with downcast eyes, wrapped in her marriage blanket (left), which she will wear at special events for the rest of her life. At the threshold of the freshly painted gateway of a relative's courtyard (below), Zanelle shields herself with an umbrella, a Western accessory adopted by Ndebele women for modesty.

Zanelle is truly married only when she completes the third stage: giving birth to her first child.





Rashaida

Reaching the Rashaida wedding wasn't easy. Besides the threat from land mines left from the Eritrean war with Ethiopia, our Land Rover's wheels repeatedly sank in the desert sand. All told, we stalled seven times, once for nearly seven hours, digging out with only a frying pan, three pots, and our bare hands. So it was a relief to reach the nomadic Rashaida and be greeted by women bearing gifts of silver rings.



The Muslim Rashaida are Bedouin merchants and renowned camel breeders, originally from Saudi Arabia. Except for trading, they keep to themselves, and they marry only their own.

Guests begin to arrive as we settle in. One man, perched high on a camel (left), escorts his three veiled wives to a wedding week of camel racing, dancing, and feasting on goat meat, wheat porridge, and sweet tea.

Bekiita, the bride, stays in seclusion, veiled behind an elaborate mask called a *burga* (right), which she has painstakingly decorated with silver thread and pendants given to her by the groom.

When the day cools at sunset, a woman breaks into a dance (below). Clapping out the rhythm, the men sing: "The sun is setting, so we sing before the dark!" As she swirls in perfumed skirts, they punctuate their song with shouts of tribal pride: "Rashaida! Rashaida!"





Himba

In the silent darkness of her hut, Ngororo places an *ekori,* a leather marriage headdress passed from mother to daughter, on 15-year-old Kavekaha (below). When the bride is ritually kidnapped by her new husband and his family, the ekori—its back shaped like the ears and horns of a cow—is rolled down to cover her face.

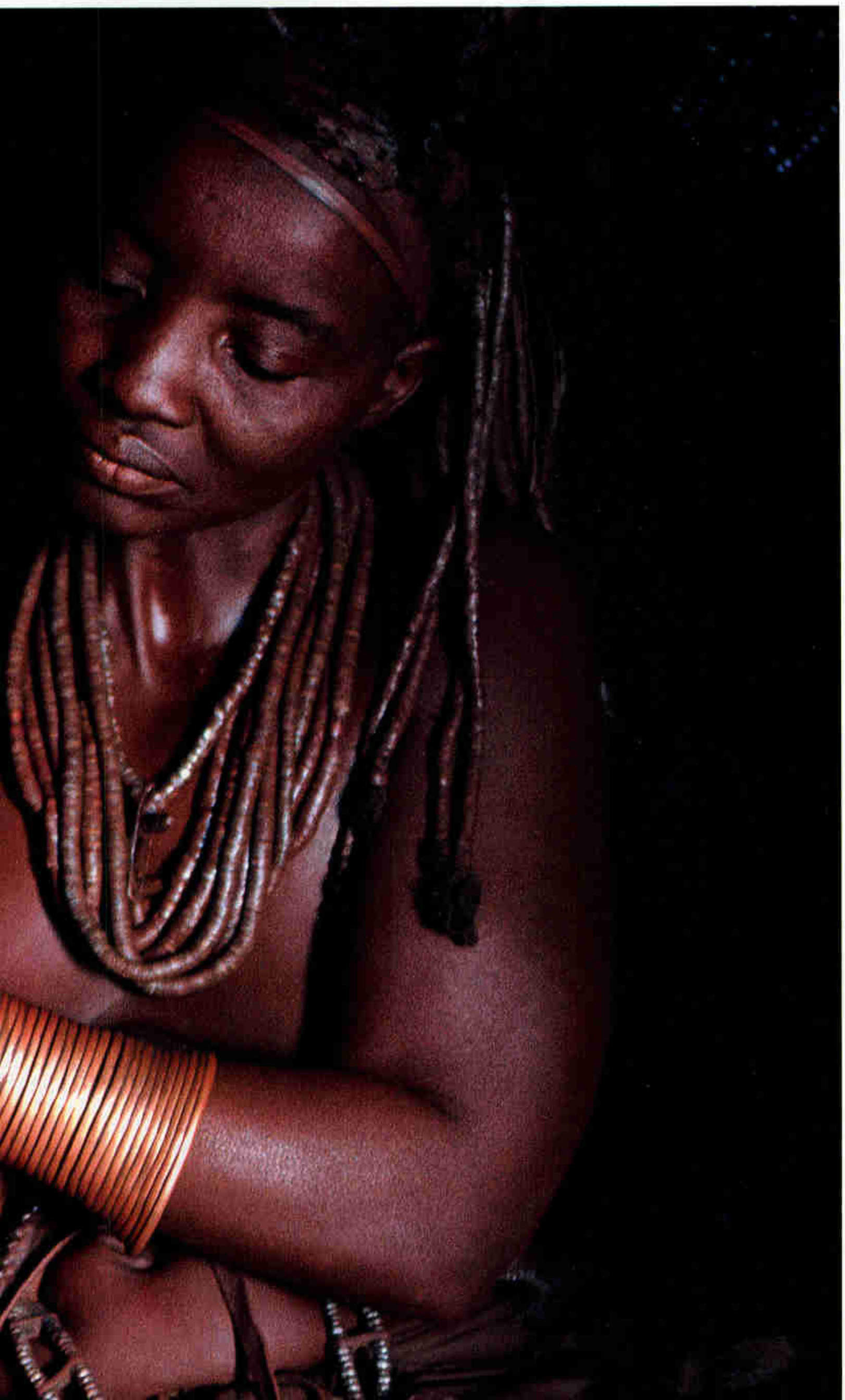
Symbolism surrounds the Himba, who herd cattle in Kaokoveld in northwestern Namibia. The women slather themselves with red ocher and butterfat mixed with





herbs and resin, displaying the rich red color of earth and blood that symbolizes life. For the wedding itself, Kavekaha wore a fresh covering scented with the ground rinds from oranges we presented her.

The day before, a lively celebration honored the couple. To the beat of singing and clapping, Verigera led the





ondjongo dance, spreading her arms to imitate the horns of a cow (top). Kavekaha's best friend kicked up a little dust with her own energetic dancing (above).

Arriving at her husband's home, the bride is instructed on the duties expected by her new family, who show their acceptance by anointing her arms, breasts, and belly with butterfat from the cows of the groom or his father.

Masai

A single tear marks the moment of farewell for lavishly beaded Nosianai (right) as she leaves her family home in the Loita Hills of southern Kenya. Wedding-day tears may express true sadness among Masai girls, who submit to arranged marriages with much older men whom they barely know. Before she departs, Nosianai's



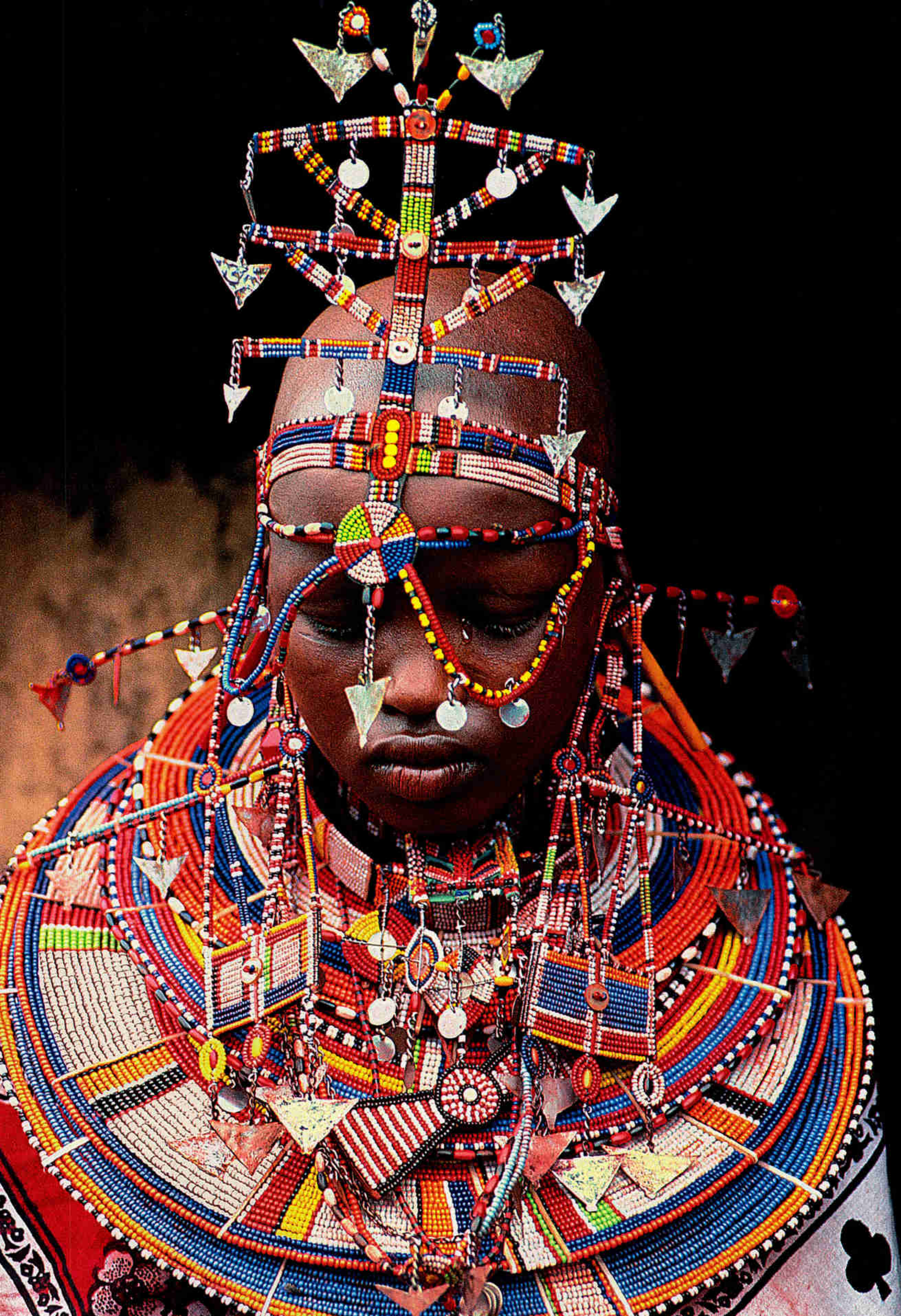


father spits a blessing of milk on her head and breasts (left), saying, "*Mekinchoo enkai enkerra kumok*—May God give you many children." As she leaves, family and friends warn her not to look back, voicing the superstition that she will turn to stone. The groom's attendant makes certain that nothing obscures the bride's path to her new husband's home, removing branches and leaves and even carrying her across streams.

As the bridal party nears, they are met by the groom's female relatives, who hurl insults at Nosianai to ward off bad luck. "You are as short and bowlegged as a Pygmy!" they shout, the ultimate slur to typically tall Masai. Then they slap handfuls of cow dung on top of her head. How she handles the abuse is believed to determine how she will face the challenges of marriage.

At her mother-in-law's hut (above), Nosianai follows Masai tradition by formally refusing to enter until she is satisfied with the gifts her new family offers. □

CAROL BECKWITH and ANGELA FISHER describe these marriage practices and other rituals in *African Ceremonies*, published this fall by Harry N. Abrams, Inc.



New fossil discoveries show that feathers were more widespread in dinosaurs than previously thought. Because so many of its relatives had feathers, scientists now think *Tyrannosaurus rex* may have had them too at an early stage. Hatchlings would have shed their downy feathers as they grew.

FEATHERS FOR T. REX?

NEW BIRDLIKE FOSSILS ARE MISSING LINKS IN DINOSAUR EVOLUTION

BY CHRISTOPHER P. SLOAN
SENIOR ASSISTANT EDITOR

PHOTOGRAPHS BY
O. LOUIS MAZZATENTA

DINOSAURS will never look the same. The reason: four new dinosaur fossils with stunningly birdlike bones and indications of feathers. Not enough to prove that these dinosaurs ever flew but strong evidence that feathers were widespread among meat-eating dinosaurs—the group that includes *Tyrannosaurus rex.*

Three of the fossils were found recently in Liaoning Province, China, the area that produced fossils of flightless feathered dinosaurs in 1996-97. All four are theropods, or meat-eaters: a dromaeosaur, one of a family of small- to medium-size predators that includes *Jurassic Park*'s "raptors"; an oviraptorosaur from Mongolia with a birdlike tail; a seven-foot-long therizinosaur; and a creature that has the arms of a bird and the tail of a dinosaur.

Twenty years ago when John Ostrom, a

ART BY MICHAEL SKREPNICK

A FLYING DINOSAUR?



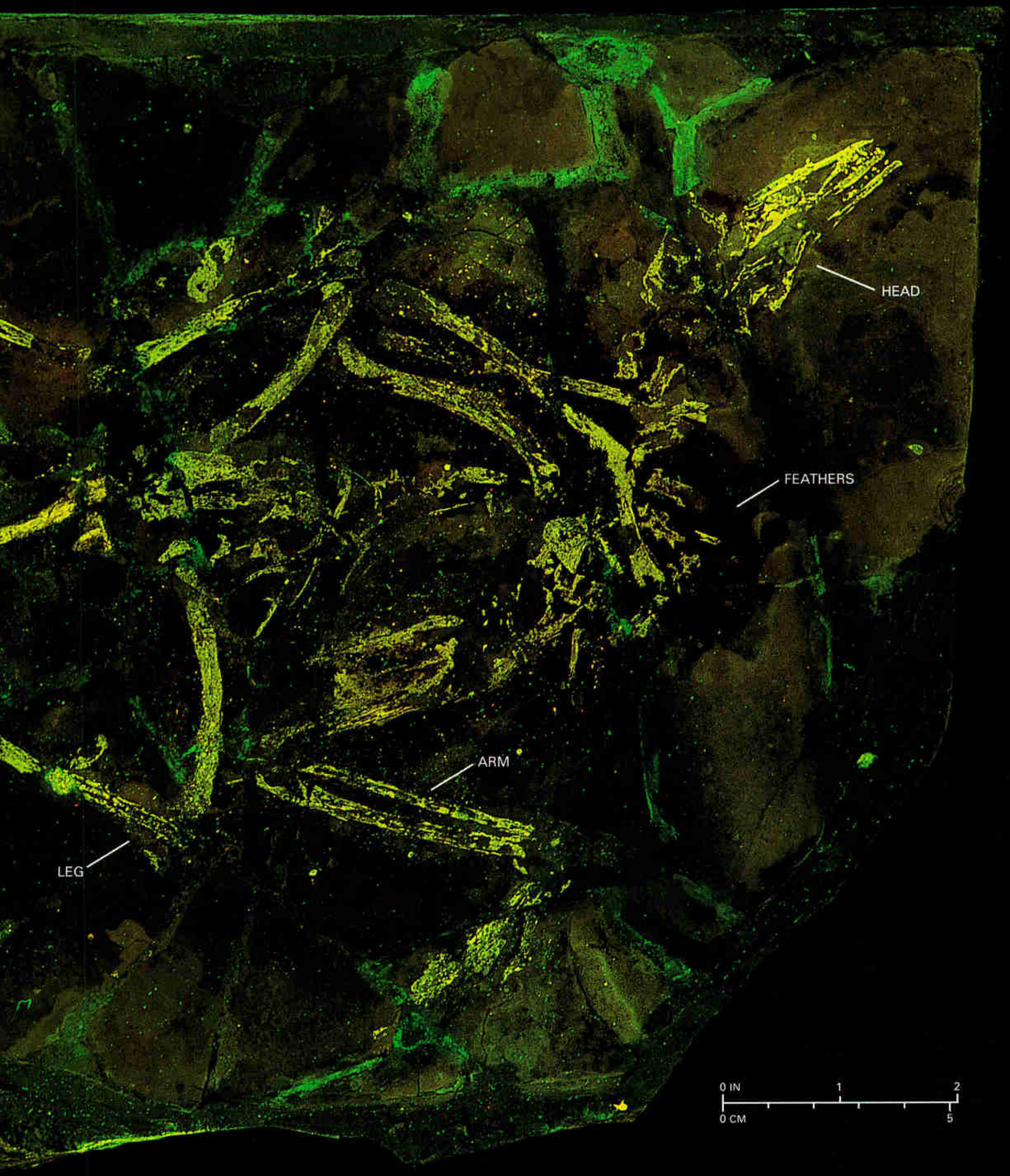
MODEL BY STEPHEN CZERKAS

"IT'S A MISSING LINK

between terrestrial dinosaurs and birds that could actually fly."

—STEPHEN CZERKAS

With arms of a primitive bird and the tail of a dinosaur, this creature found in Liaoning Province, China, is a true missing link in the complex chain that connects dinosaurs to birds. Scientists funded by National Geographic studied the animal, named *Archaeoraptor liaoningensis,* under ultraviolet light (above) and used CT scans to view parts of the animal obscured by rock. Preliminary study of the arms suggests that it was a better flier than *Archaeopteryx,* the earliest known bird. Its tail, however, is



strikingly similar to the stiff tails of a family of predatory dinosaurs called dromaeosaurs. This mix of advanced and primitive features is exactly what scientists would expect to find in dinosaurs experimenting with flight. Stephen Czerkas, who led the study of the specimen, reconstructed the new animal (inset), which resembles *Archaeopteryx*. "This fossil is perhaps the best evidence since *Archaeopteryx* that birds did, in fact, evolve from certain types of carnivorous dinosaurs," says Czerkas.

respected paleontologist at Yale University's Peabody Museum of Natural History, proposed that birds descended from theropods, many scientists viewed him as a radical. But the clear impressions of feathers on the Liaoning fossils lengthen the list of feathered theropods, and we can now say that birds are theropods just as confidently as we say that humans are mammals. Everything from lunch boxes to museum exhibits will change to reflect this revelation.

A simple paper sign with "Chris" scribbled on it, tacked to a weathered post, is my signal to turn into the Czerkas ranch in southeastern Utah. It's May 1999, and I'm about to meet up with one of the Chinese specimens that, right now, only a few people know about. Stephen and Sylvia Czerkas, directors of the Dinosaur Museum in Blanding, found it early this year at a gem and mineral show. Immediately recognizing its scientific value, they found benefactors and purchased it quietly, planning to give it a home in the museum. "We wanted to make sure it didn't end up on a mantel in someone's private collection," says Sylvia.

RESEARCH PROJECT

Supported in part by your Society

According to Chinese officials any fossils leaving China—including countless bird specimens and dinosaur eggs that have appeared on the international market—are illegal exports. So, after completing their study of the fossil, the Czerkases now plan to return it to China.

Stephen draws me into a back room to view the animal he will later name *Archaeoraptor liaoningensis.* I've seen feathered dinosaur specimens, but what Stephen shows me takes my breath away. Its long arms and small body scream "Bird!" Its long, stiff tail—which under magnification erupts into a series of tiny support rods paralleling the vertebrae—screams "Dinosaur!"

Surrounding the bones, which suggest that the animal is a dromaeosaur-like primitive bird, are the remains of feathers. Some are similar to the hairlike protofeathers of the flightless *Sinosauropteryx* found in 1996.* But others look long and broad, seductively suggesting flight feathers. "It's a missing link," Stephen says. "We can't prove that it flew, but even aside from its feathers, its anatomy—long arms, birdlike shoulders, hands, and wrists—doesn't make sense unless it did."

Three weeks earlier I had viewed the other two Liaoning fossils at the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing. The first, a dromaeosaur, was an eagle-size creature named *Sinornithosaurus millenii,* "Chinese bird-reptile of the millennium." It was exquisitely fierce looking, with barracuda-like teeth and long curved claws. It reminded me of John Ostrom's description of dromaeosaurs: "bizarre killing machines."

Paleontologist Xu Xing showed how the bones of *Sinornithosaurus millenii*'s shoulder girdle—the scapula, coracoid, and furcula—are more like those of a bird than those of a dinosaur. Critical for flight, these bones join at the glenoid fossa, a cup-shaped area that determines the degree to which a bird can raise its wings above its shoulder to flap. "If you saw just this shoulder girdle, you would think it was *Archaeopteryx,* the earliest bird," he said.

In a room across a dimly lit hall Xu

*See "Dinosaurs Take Wing," by Jennifer Ackerman, in the July 1998 NATIONAL GEOGRAPHIC.

FROM GROUND TO AIR

Fast, bipedal meat-eaters called theropods have four new species: *Sinornithosaurus millenii, Beipiaosaurus inexpectus, Archaeoraptor liaoningensis,* and an unnamed oviraptorosaur. Beginning with the primitive *Sinosauropteryx,* all theropods, including *T. rex,* may have had feathers, one of the adaptations that led to flight in *Archaeopteryx* and perhaps *Archaeoraptor.*

Former Senior Assistant Editor LOU MAZZATENTA photographed evidence of the earliest life on Earth for the magazine's March and April 1998 issues.

showed me the other feathered theropod, *Beipiaosaurus inexpectus*, one of only a few therizinosaur specimens known. Farmers discovered the gray bones near the town of Beipiao and discarded them, believing they had no commercial value. Xu and his colleagues chanced upon scraps of the fossil and salvaged the remaining pieces from the site.

The young scientist handed me a flat piece of rock about the size of my hand. It bore pink comblike impressions that suggested stiff, narrow feathers. "These filaments might have had hollow cores," he said. This is a key feature, since hollow, hairlike structures characterize protofeathers—evolutionary intermediates between reptilian skin and feathers.

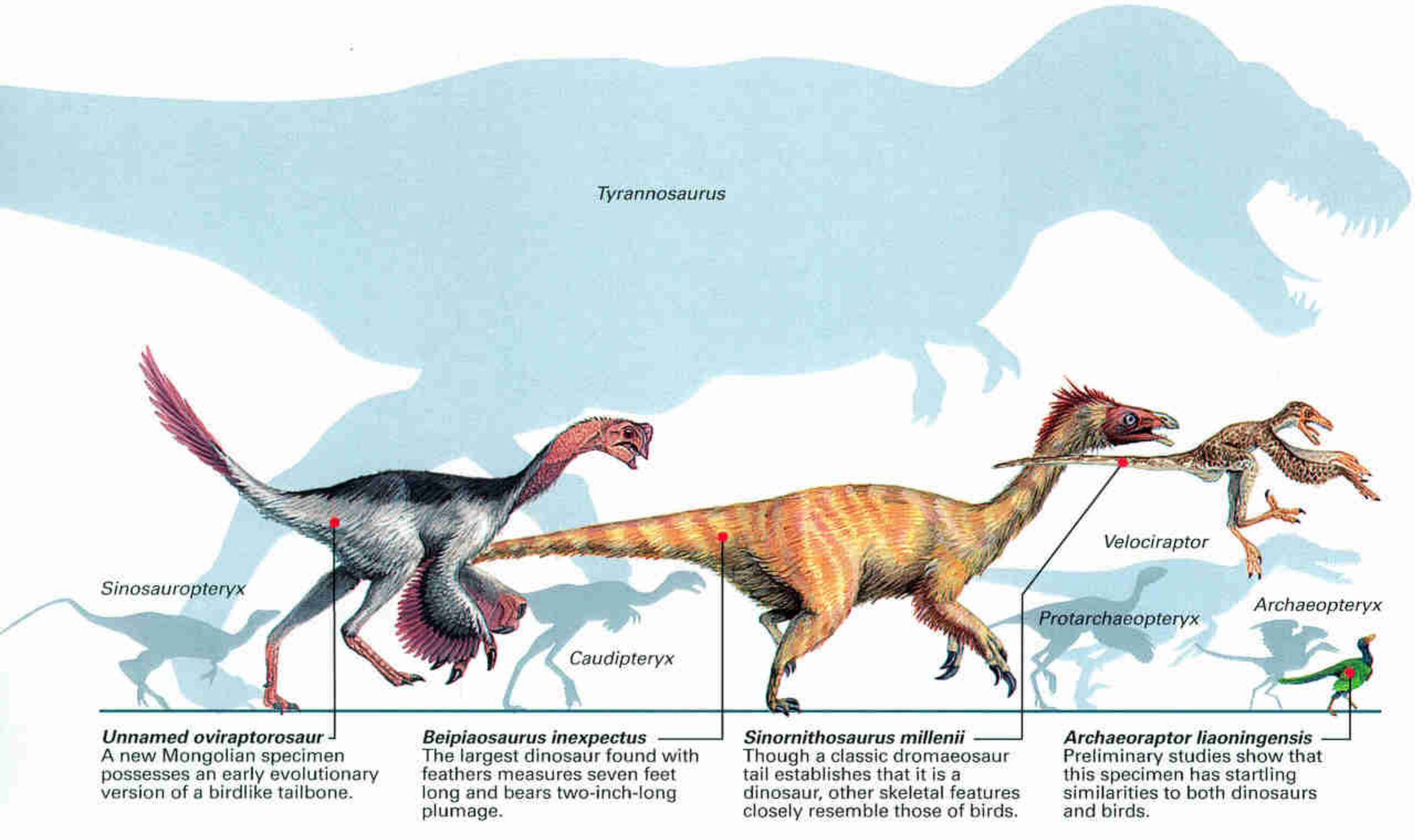
At seven feet long, *Beipiaosaurus* is the largest dinosaur yet found with feathers. But why did it have them, since neither this therizinosaur nor its ancestors ever flew? One explanation is that their feathers did not evolve for flight but for insulation—which gives rise to another question: Were dinosaurs warm-blooded?

Biologist Mary Schweitzer of Montana State University, who has studied the small fibrous structures on a birdlike creature from Mongolia named *Shuvuuia deserti*, is helping to answer that question. Her tests show that the fibers are similar, chemically and structurally, to modern feathers. "The only animals living today with body coverings of hair or feathers



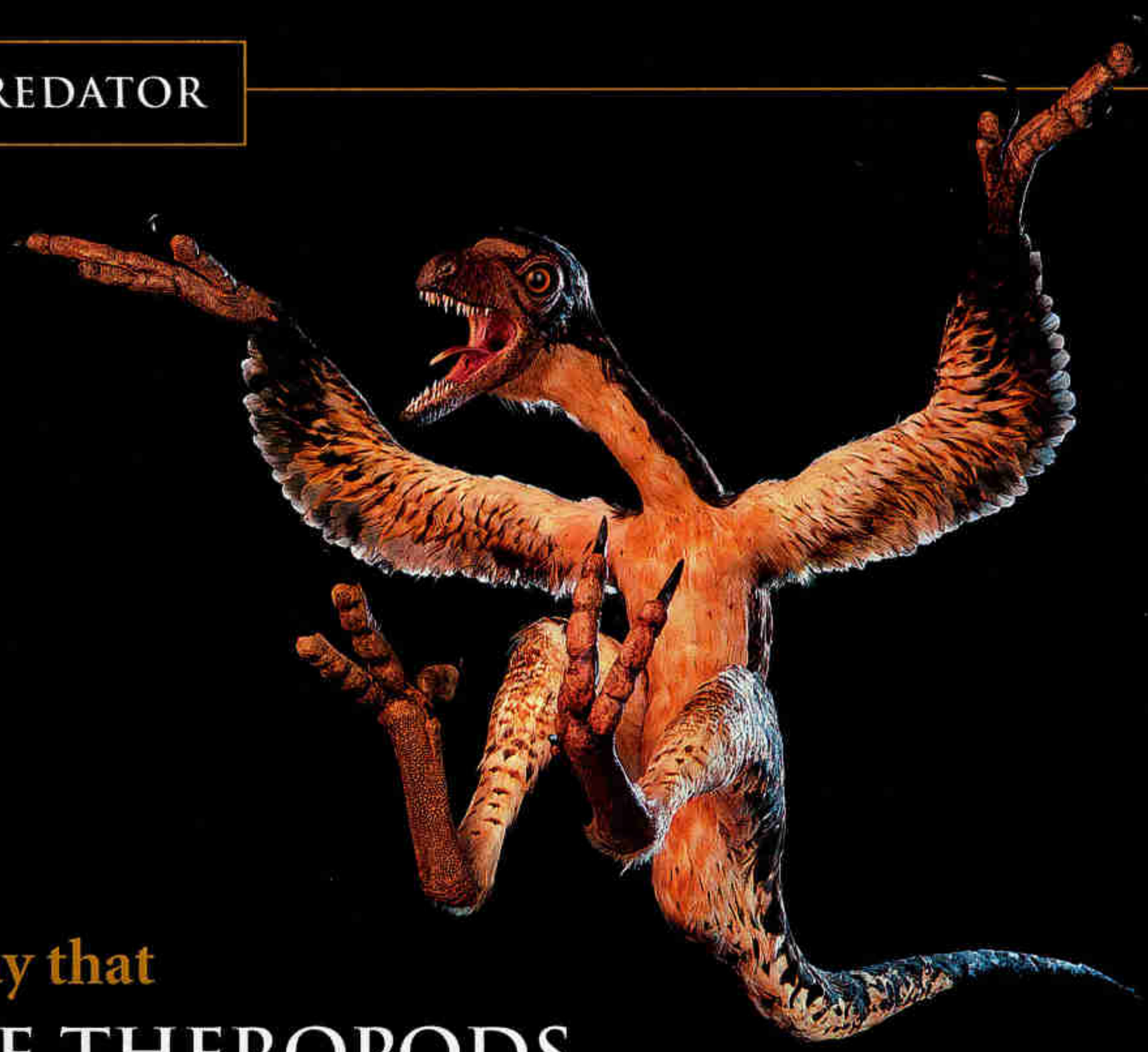
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Obsolete model: Baby *T. rex* in 1997's *Lost World: Jurassic Park* probably would have feathers if the movie were made today.




HEAD
WISHBONE
FEATHERS
TAIL
0 IN 1 2
0 CM 5

FEATHERED PREDATOR



We can now say that

BIRDS ARE THEROPODS

just as confidently as we say that humans are mammals.

Halo of feathers radiates from the fossilized bones of *Sinornithosaurus millenii* (left), which lived more than 120 million years ago. A sculptor's depiction (above) shows it pursuing prey; it probably fed on lizards and small mammals. Although the creature was apparently covered with downy feathers, it could leap but not fly. However, its boomerang-shaped furcula, or wishbone (far right), resembles that of the primitive bird *Archaeopteryx*, according to paleontologist Xu Xing. Resting near two claws, the tail vertebrae anchor bundles of slim bony rods (below) that stiffened the tail to aid maneuverability. This feature identifies *Sinornithosaurus* as a dromaeosaur, one of the most effective predators of its day. The fossil also supports the concept that early feathers evolved for insulation or display rather than flight and adds new weight to the idea that these dinosaurs were warm-blooded.

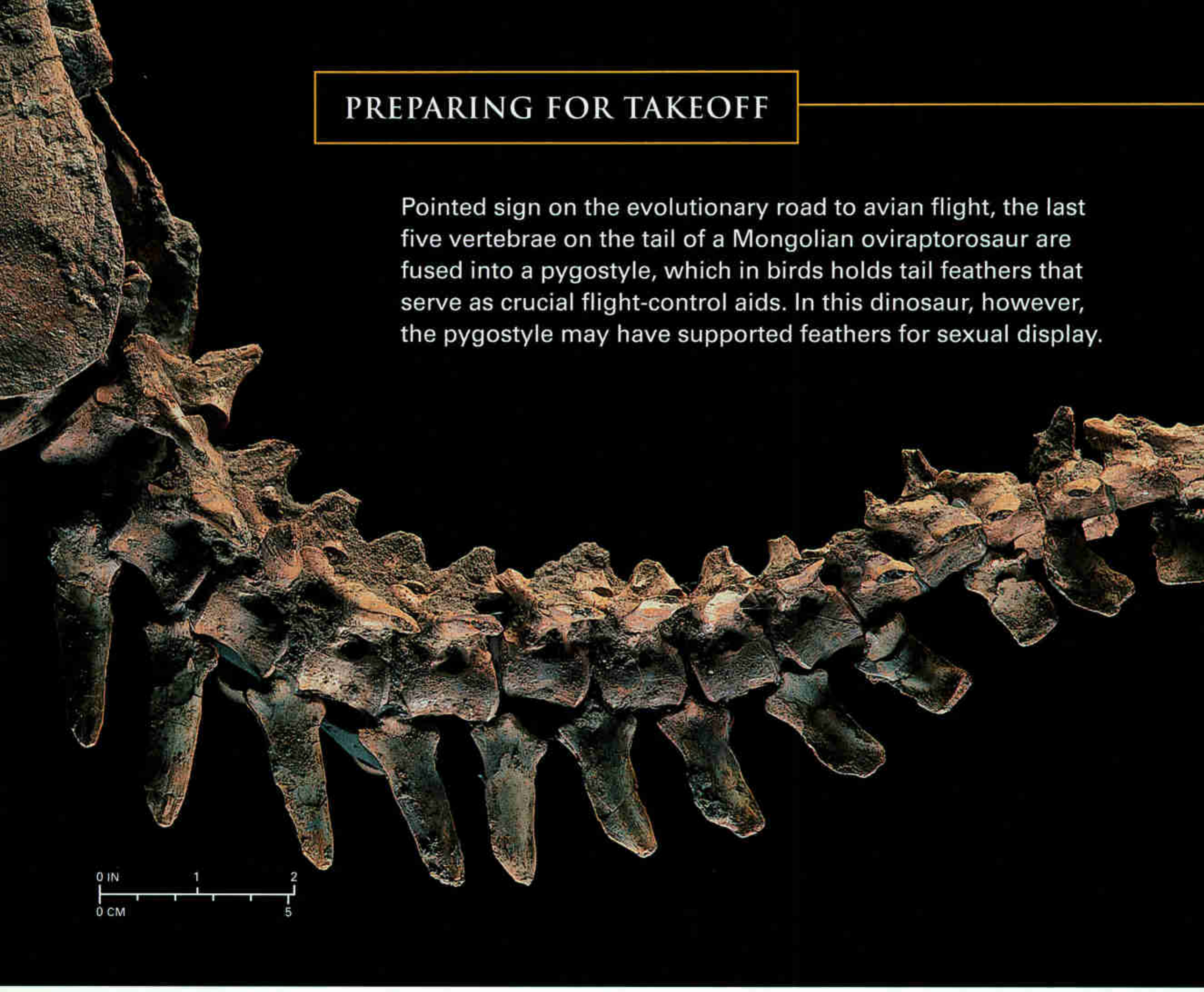


MODEL BY BRIAN COOLEY

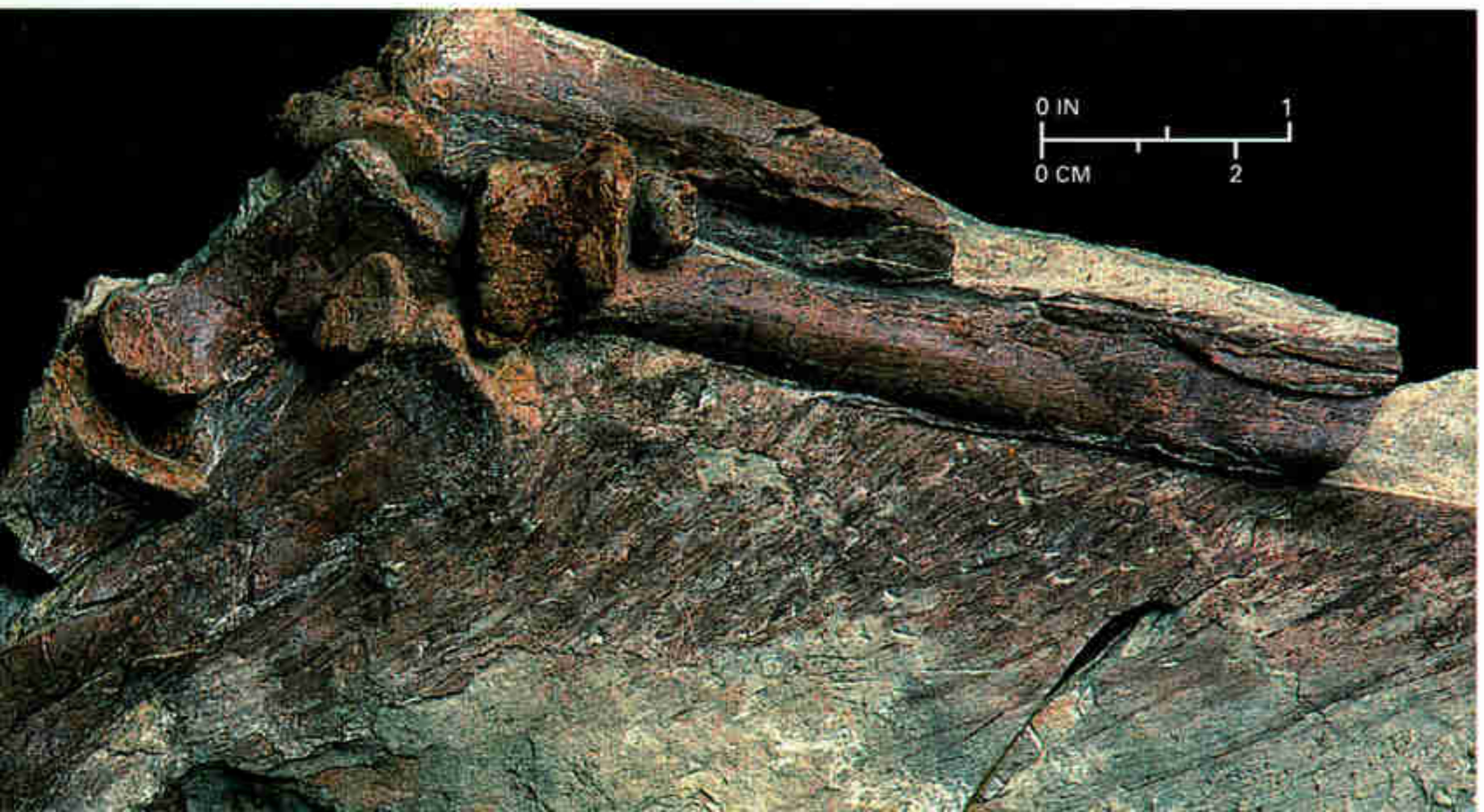


PREPARING FOR TAKEOFF

Pointed sign on the evolutionary road to avian flight, the last five vertebrae on the tail of a Mongolian oviraptorosaur are fused into a pygostyle, which in birds holds tail feathers that serve as crucial flight-control aids. In this dinosaur, however, the pygostyle may have supported feathers for sexual display.



Largest feathered dinosaur yet found, *Beipiaosaurus* was a therizinosaur, a long-necked, long-clawed theropod. Its wispy feathers, which extended two inches from the forearm (below), were used not for flight but probably for insulation. "I think therizinosaurs 'chose' a slower lifestyle, evolving from meat-eaters to plant-eaters," says Xu Xing, who is studying the fossil at China's Institute of Vertebrate Paleontology and Paleoanthropology in Beijing.



have the high metabolic rates of warm-blooded creatures," she says. "It seems reasonable to assume that this was true in the past as well. Dinosaurs that possessed body coverings were probably either warm-blooded or had metabolic rates significantly higher than those of modern cold-blooded animals."

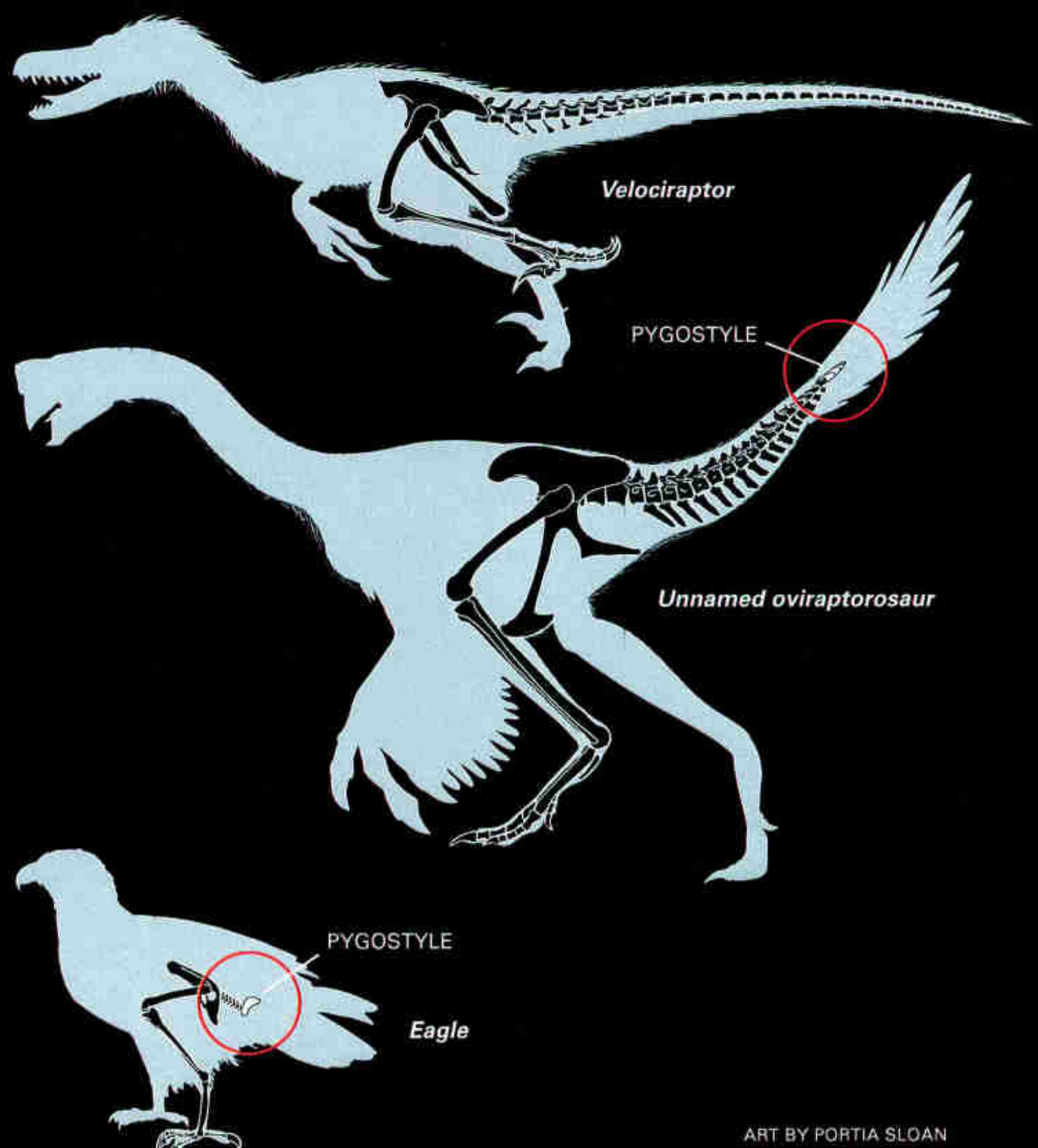
But the larger an animal becomes, the less likely it is to need a coat of hair or feathers for insulation, since large bodies generate more heat. The last thing an adult *T. rex* in a subtropical Cretaceous world would have needed was a warm coat. "If adult *T. rex* had feathers, it was probably only for display," says Philip Currie, theropod expert and curator of dinosaurs at the Royal Tyrrell Museum in Drumheller, Alberta.

But what about *T. rex* juveniles? "Baby animals have less

Acting as a counterbalance, the tail of *Velociraptor* (top right) is composed of many vertebrae. In an oviraptorosaur (center) the tail has fewer

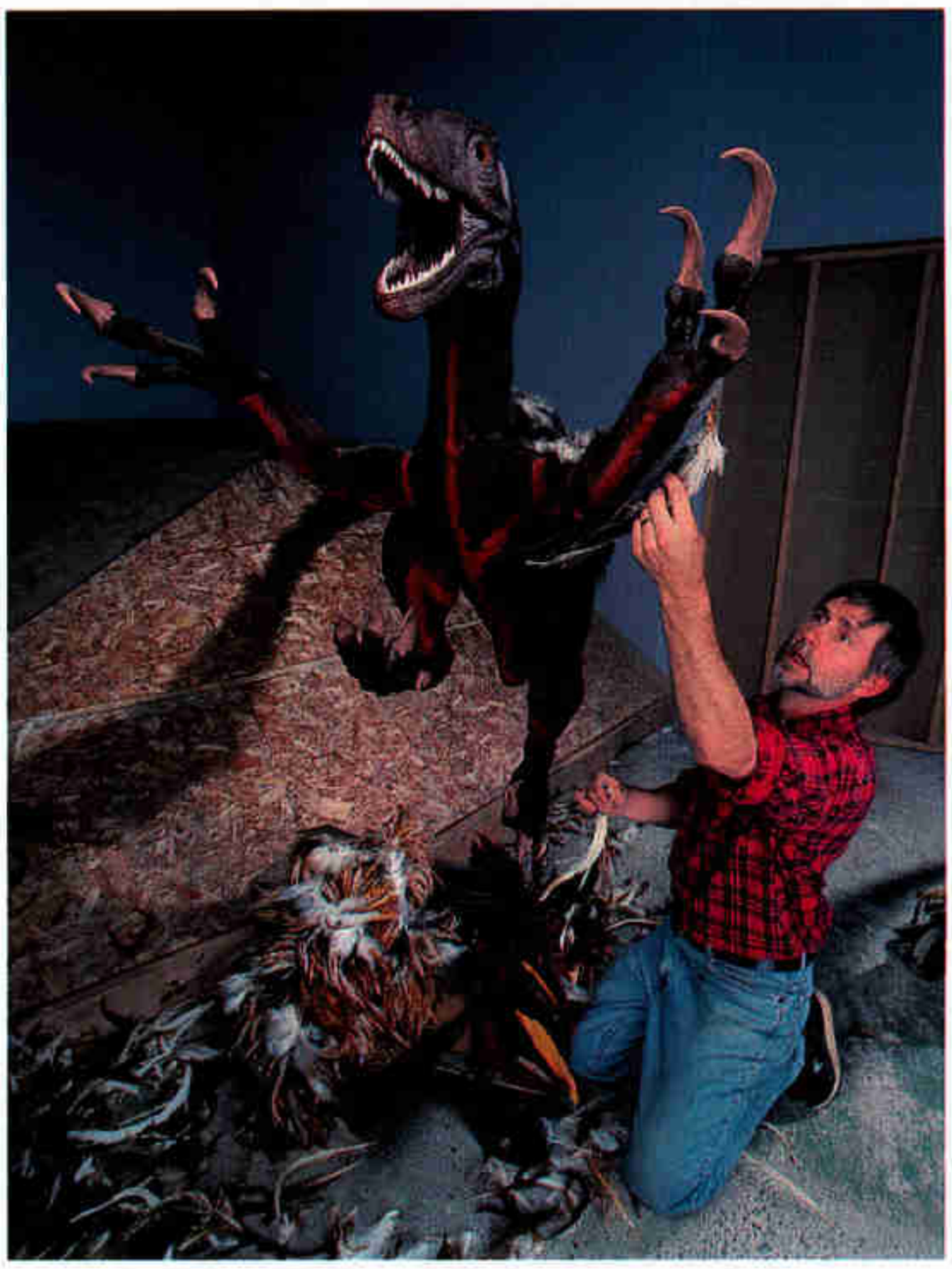


vertebrae and ends with an incipient version of the pygostyle. As birds evolved, the tail drastically shortened, as in an eagle (bottom). The pygostyle's tail feathers serve the bird in flight maneuvers and in displays to attract mates and intimidate rivals.



ART BY PORTIA SLOAN

Mounting fossil evidence that feathers were common among theropods led Stephen Czerkas of the Dinosaur Museum in Blanding, Utah, to add plumage to an earlier model of a dromaeosaur called *Deinonychus* (right). Depictions of many theropod species may change as museums rethink the appearance of these precursors of modern birds.



control of their body temperature than adults," says Currie. "*T. rex* hatchlings needed a way to stay warm. What would be more logical than insulating feathers?"

A photograph of a bird in flight freezes its wings in a pose—a mere suggestion of the complicated process of flight. In a similar way the new Liaoning fossils create a snapshot of reptilian skin evolving into feathers. Perhaps someday a new discovery will capture the moment when a flying dinosaur became a bird. □

For a 3-D view of a feathered dinosaur, go to *www.nationalgeographic.com/dinorama.*

AFTER THE DELUGE

CENTRAL AMERICA'S STORM OF THE CENTURY

BY A. R. WILLIAMS
NATIONAL GEOGRAPHIC SENIOR STAFF

PHOTOGRAPHS BY VINCENT J. MUSI

Mud and debris piled high by flooding form one of the many obstacles that residents of Tegucigalpa, the capital of Honduras, must surmount after Hurricane Mitch devastated the region a year ago. Areas hardest hit are still struggling to recover.





A towering wall of mud, rocks, and uprooted trees rumbled down the south flank of Nicaragua's Casita Volcano on Friday, October 30, 1998, as men tended their fields of corn, beans, and rice and women cooked the midday meal over woodstoves in villages across the fertile green slope. It had been raining hard the whole week as Mitch—downgraded from hurricane to tropical storm—stalled. Finally the sodden earth at the top of the mountain gave way.

"We heard a sound like a plane, and we thought people had come to rescue us because our houses were filling with rain," said Vilma Urrutia Martínez, a young mother from the town of Rolando Rodríguez. "But 15 minutes later the land began to tremble, and the mud and stones were on top of us. My children and I went rolling with everything that came down, including pieces of our house."

When the mudslide ended, a deep orange gash a mile wide and ten miles long ran toward the Pacific coast. Rolando Rodríguez, with 1,600 residents and 176 houses, lost at least 455 people and virtually all its houses. El Porvenir, nearby, was also devastated, losing 79 of its 80 houses and at least 286 of its 700 inhabitants. Several other villages were sideswiped. In all some 2,000 people died.

The Casita disaster was the worst single event during a storm that killed more than 11,000, left more than two million homeless, and caused ten billion dollars in damage across the region. Nearly all of Central America was affected, from Nicaragua and Honduras through El Salvador, Guatemala, Belize, and southern Mexico. In the history of Atlantic storms only one surpasses Mitch: the Great Hurricane of 1780, which killed 22,000 people in the eastern Caribbean.

The survivors of the mudslide took refuge in schools hastily converted to shelters in towns at the base of the volcano. It was there that I visited them three weeks after the storm. When I met Vilma Urrutia, she was sitting quietly with a few relatives late one afternoon in the courtyard of an elementary school in Chinandega. At the far end two boys bounced a basketball—the only activity amid 65 stunned men, women, and children, many in bandages or casts or using crutches. "We don't know what to do," said Vilma's sister Juana. "We were left with nothing. Nothing."

Vilma had just lost two of her four children, but it wasn't until María Urrutia Ramírez, her cousin, began to speak that I began to understand everything they had been through. María, also from Rolando Rodríguez, was 38 years old and eight months pregnant. "I was stuck in mud up to my chest until they rescued me," she said. "I waited Friday, Saturday, and most of Sunday for help."



In the chaotic aftermath of the storm it had taken several days to get the word out, to round up rescuers and equipment, and to transport everyone over roads and bridges wrecked by flooding.

"I lost my daughter Ana María and her four-month-old son," María continued. "The current took them away." Two other children, Martha and Wilber, were also killed, and a 17-year-old daughter, Yasmina, who was in the hospital with a hole punched in her leg by a rock, would die a month later. Her daughters Jessica and Paula and son Yarling were bruised but all right. "My baby's due in December," she added in almost a whisper, drained by the physical and emotional shock.

Standing at María's side, 18-year-old Paula—who had lived with her husband, Ballardo Sandoval, a farmer in El Porvenir—told her story.

VINCE MUSI, a frequent contributor, first teamed up with writer A. R. Williams for our July 1997 article on the Montserrat volcano. His work has also appeared in *Life, Fortune,* and the *New York Times Magazine.*

KILLER FLOODS

Days of heavy rain deluged country after country, killing thousands. In Guatemala a river rips through the town of Gualán. In Chilanguera, El Salvador, a family mourns a son who drowned. "We've seen hurricanes before," says a survivor in Honduras. "What we didn't expect was so *much* rain. There wasn't one riverbed or ravine that didn't fill with water."





ALVARO LOPEZ, *EL DIARIO DE HOY* (TOP); RAÚL MEONO, *NUESTRO DIARIO*/ASSOCIATED PRESS

During the last days of October, late in the 1998 hurricane season, Mitch took shape off the coast of South America. Spinning northward, it became one of the strongest hurricanes ever recorded, with gusts of more than 200 miles an hour. As it slowed to a tropical storm and began to crawl across Honduras, rain replaced wind as the destructive force. Runoff eroded mountainsides and fed rivers that scoured valleys. The Choluteca River overran its banks and in its southernmost stretch dumped sand, mud, and stones on part of the city of Choluteca and nearby farms (1). Along the Nicaraguan coast runoff built a delta at the mouth of an inlet and swirled for miles into the Pacific Ocean (2).

San Pedro Sula

San Salvador

Tegucigalpa

Pacific Ocean

1 Choluteca

2

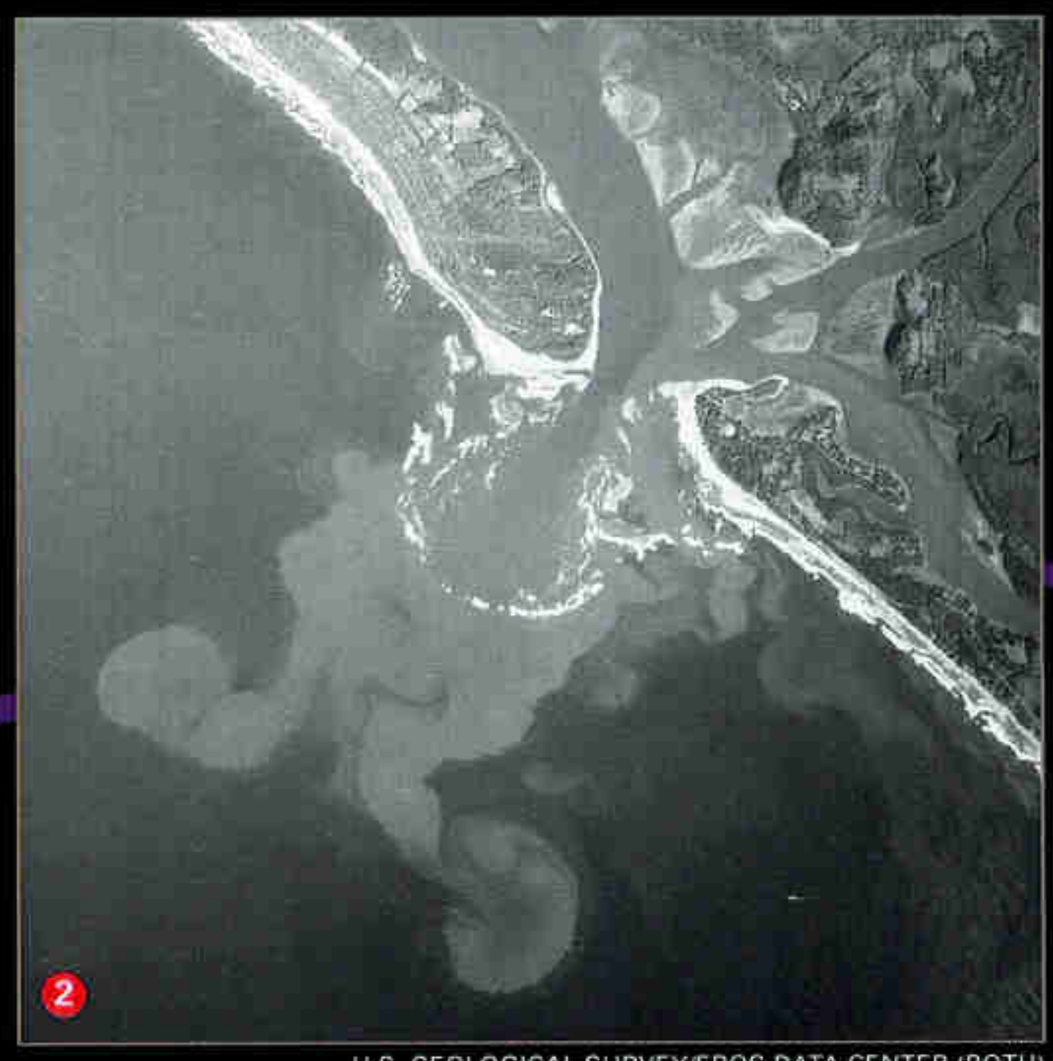
+ *Casita Volcano*

"Slow-moving tropical weather systems near the mountainous land areas of Central America and Mexico inevitably lead to huge amounts of rainfall," says meteorologist Richard J. Pasch of the National Hurricane Center in Miami, Florida. Yet even among such systems Mitch was exceptional, dumping three or more feet of rain on some places. "Nothing like this ever happened here before. Not Hurricane Fifi, not Gilbert, never," says a shop owner in Tegucigalpa, citing the big storms of 1974 and 1988. "We got a little water in the streets, but not a flood."

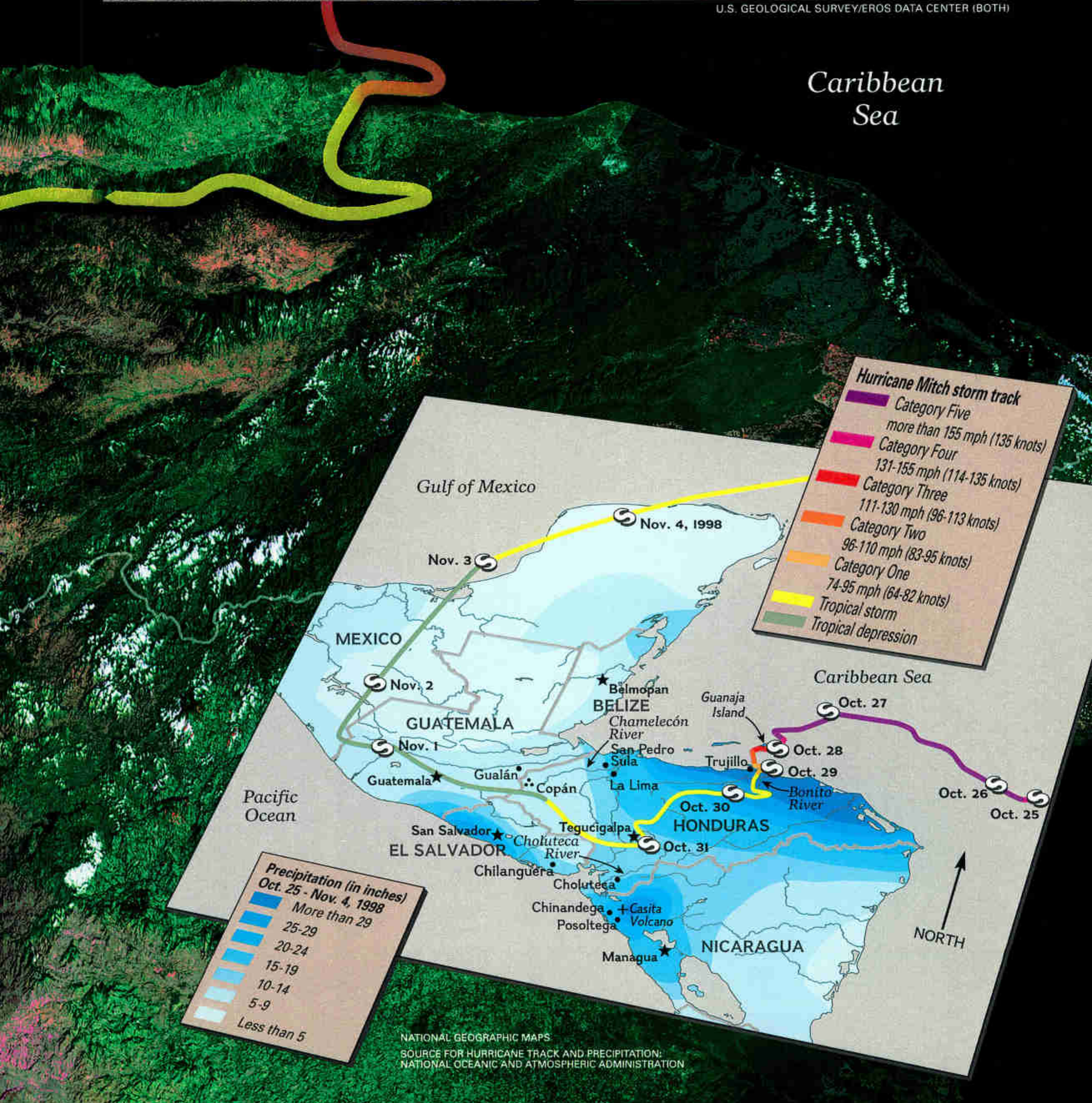
LANDSAT MOSAIC BY U.S. GEOLOGICAL SURVEY/EROS DATA CENTER; NOAA SATELLITE IMAGE (GLOBE AT TOP) PROCESSED BY GODDARD SPACE FLIGHT CENTER, NASA

A TRAIL OF DESTRUCTION





U.S. GEOLOGICAL SURVEY/EROS DATA CENTER (BOTH)



NATIONAL GEOGRAPHIC MAPS

SOURCE FOR HURRICANE TRACK AND PRECIPITATION: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

"The mountain just exploded. I saw everything coming but couldn't move. The mud was like quicksand, sucking me right down. I moved my legs as if I were climbing stairs and finally got myself out at five that evening. I must have looked like a monster. My face was all scratched, and I was sobbing because I thought I had lost my mother and all my brothers and sisters."

Paula took me around the shelter, introducing me to the others: a man who had lost his parents, his wife, and his three children; an orphaned boy with only his grandmother to care for him; a young woman who figured that 20 had died in her extended family.

In the room she shared with about a dozen others, Paula showed me her cot, neatly made up with a white sheet. She touched the neighboring cot, pushed up against hers. "This is my mother's," she said softly.

Three months after my initial visit, I made a second trip to Nicaragua and Honduras to find out how people were coping and how they were beginning to rebuild their lives. When I saw Paula and María again, they were still side by side. They had moved to a village called Los Charcos, where María's father lived, about 20 miles from Rolando Rodríguez as the macaw flies and out of sight of the Casita Volcano. María was visiting a friend in a wattle-and-daub, thatch-roofed hut with no lights or running water. She was nursing her new son, Jason. Paula was standing beside her, and Yarling and Jessica were playing close by.

"I'm staying here," María said. "I don't ever want to see that volcano again."





In the path of a massive avalanche of rain-soaked earth that killed some 2,000 people in Nicaragua, volunteer Dionisio Rodríguez Rizo pauses after burying bodies found near his village. Several miles in the distance a scar on the side of the Casita Volcano reveals the origin of the deadly slide. A simple cross marks one muddy grave (left).



REPAIRING NORTHWESTERN Nicaragua—the most seriously afflicted part of the country—will be difficult, but the six million people of neighboring Honduras must deal with destruction across their entire territory.

"This hurricane walked all over us," said Ricardo Agurcia Fasquelle, an archaeologist who helped coordinate relief efforts. "Every major urban center was trashed."

Sustained winds of 180 miles an hour put Mitch in the rare Category Five, last used for Hugo in 1989. Slowing slightly, Mitch stripped Guanaja, an island off the north coast, and then moved south, dumping several feet of rain in just a few days. Homes and businesses concentrated in the river valleys between mountains were flooded, and more than 5,000 Hondurans drowned or died in landslides. Tens of thousands of acres of land were swept away or buried too deeply to be farmed. At least a thousand miles of roads and more than a hundred bridges were left impassable.

In the Sula Valley in northern Honduras the visible damage included almost 25,000 acres of banana plants, toppled by rivers that broke through levees six feet tall and 30 feet wide. "Their force was unstoppable," said Arnaldo Palma, general manager of Chiquita's 16,000-acre operation in Honduras. Writing off 73



Waiting for her flooded home to dry out, Gladys Mejía cares for her son in a tent city built hastily on a highway in Honduras. "That was the only place not underwater in the whole La Lima municipality," says a neighbor.

million dollars in lost fruit and damage to equipment, roads, and levees, Chiquita has begun to repair and replant its flooded fields.

"This is going to be a hard year for banana workers," said Palma. Most of the company's 7,300 employees have had to look for temporary jobs to supplement loans from Chiquita and garden plots the company has let them use to tide them over until banana production begins to rebound—by mid-2000, Palma hopes.

"The total damage to Honduras was five billion dollars, and our national budget for 1998 was 1.1 billion," said Germán Pérez D'estephen, a director of the Chamber of Commerce in the industrial city of San Pedro Sula. "The math is simple. If we don't get help from abroad over the next ten years, it will take generations to get back to where we were."

Help began arriving right away. Mexico sent army troops and bulldozers. The U.S. military flew food, clothing, and medical supplies to remote villages and began to rebuild bridges. A group of Cuban doctors and nurses gave



victims medical care, and Red Cross volunteers from home and abroad installed water purification plants and built new homes. Japan's defense force, working outside its home country for the first time in a relief effort, helped with cleanup and reconstruction. Private citizens affiliated with churches, schools, and service organizations came from around the world to pitch in wherever they could. In addition, individual countries, development banks, and international organizations such as the United Nations pledged hundreds of millions of dollars in aid.

Putting all this assistance to work, explained Mary Flake de Flores, Honduras's first lady, will take time. "People are expecting this to happen sooner than it can. They don't understand that governments and banks just don't send 20 million dollars. To get that money, you have to present a project with every cost listed and the process of rebuilding explained."

As the Honduran government began sorting out the offers of aid, drawing up project proposals, and negotiating for forgiveness of its 4.5-billion-dollar international debt, people accustomed to being self-reliant began to put their communities back together.

FOR THE NEIGHBORHOOD of Martínez Rivera that meant shoveling mud. Spread along the Chamelecón River near San Pedro Sula, its metal-roofed homes of cinder blocks and wood are flooded almost every year in hurricane season, from June to November. "We're working people—maids, tailors, bricklayers, factory employees. We moved onto this land in 1990 to build our own houses because we couldn't afford to pay rent anymore," said Exequiel Galo Osorto, vice president of the *patronato,* the community's governing body. "It belonged to the Chiquita banana company, and they let us stay." He and his neighbors have learned to live with the rhythm of the waters.

"THE MATH IS SIMPLE. IF WE DON'T GET HELP . . . IT WILL TAKE GENERATIONS TO GET BACK TO WHERE WE WERE." — **GERMÁN PÉREZ**

"We're not afraid, because the river speaks to us," said Manuel Cardona, the leader of a marimba band. "When it rises, it pulls the water hyacinths out of its banks. We see them float by and know the river is telling us to get out." The 500 or so villagers then hoist their smaller pieces of furniture to the rafters, climb the adjacent concrete embankment to a four-lane highway, block off two lanes, and set up shelters of plywood, tarps, and cardboard.

Usually the water recedes in a couple of weeks, and everyone returns home. But this time the river left several feet of mud behind.

"If we have to dig out on our own, it will take about eight months," said Exequiel, who talked fast and walked faster as he guided me



TREACHEROUS SLOPES



An entire neighborhood slumped downhill in a landslide that blocked the Choluteca River in Tegucigalpa; adjacent areas could go at the next heavy rain. All across the region weak, weathered soils continue to pose similar hazards. “I don’t know if we will ever count them, but there were probably more than a million landslides created by this storm,” says Bruce Molnia, a geologist at the U.S. Geological Survey.

through the drier parts—only ankle deep in muck. "We want the government to lend us bulldozers to clear the streets. We'll do the rest. We don't have any money to rent machines like that, but we do have lots of strong arms and a willing spirit."

We passed evidence of that: a woman in a red skirt and black rubber boots who was trying to sweep the slop from her house, though it kept oozing back. Her name was Estela Rosa Ramírez, and she displayed remarkable equanimity. "As you can see, the floor is still wet. I guess I'll start washing down the walls," she said simply, before turning to cook some tortillas over a wood fire.

Three months later the bulldozers had come and gone, and most of the people of Martínez Rivera had moved back into their houses. Washing hung from lines, and sofas were drying beside pink-flowering hibiscus bushes. "Mitch is history," said Exequiel, as he and a crew of women cleared trash from their former campsite. "It's time to get on with our lives."

In an effort to encourage people to leave such vulnerable areas and to resettle those who had lost their homes, the government of San Pedro Sula was planning a new model neighborhood. With help from the Inter-American Development Bank, it had bought nearly 200 acres of land a 20-minute bus ride to the southwest. Each of 4,000 families who wanted could buy a lot of roughly 50 by 30 feet and the materials to build a kitchen, one room, and one bath. These houses would cost 35 dollars a month for 20 years; additions could be made if families could find the extra money.

"WE DON'T HAVE ANY MONEY TO RENT MACHINES . . . BUT WE DO HAVE LOTS OF STRONG ARMS AND A WILLING SPIRIT." — EXEQUIEL GALO

But that was hard to imagine. For those lucky enough to have full-time jobs, the minimum wage in the area—the least impoverished in Honduras—is about $80 a month. Seventy percent of the people live below the poverty line and have no savings. The only people I found in Martínez Rivera who said they would like to move were two elderly women who thought that the government was giving away land and that I was writing down the names of everyone for the giveaway.

"I'm staying right here," said Exequiel Galo. "I've invested sweat and sacrifice, and no one will reimburse me for that. It makes more sense to fix up what I own than to take a chance on buying something new." Stacks of lumber filled his front yard, and fresh clapboards framed his front door.

Taking on house payments now, with the national economy knocked almost flat, would be especially risky. "Last year we had a 3 percent growth rate. This year we expect a negative 3 percent," said Germán Pérez of the San Pedro Sula Chamber of Commerce. "Agriculture makes up three-quarters of our exports, and that was the sector affected most severely—bananas, coffee, shrimp, melons."

LEAVING SAN PEDRO SULA, I followed the path of destruction south to Tegucigalpa, the Honduran capital, where the homes of nearly a million people fill the valley of the Choluteca River. "We never imagined a hurricane would hit here," says Ricardo Agurcia, the archaeologist, who splits his time between the city and the Maya site of Copán. "At 3,000 feet, surrounded by mountains, we thought we were protected." But valleys anywhere are vulnerable: In 1974 Tegucigalpa suffered its share of the trauma associated with Fifi, a hurricane responsible for as many as 10,000 deaths in Central America.

With Mitch, dams overspilled or burst on rain-swollen tributaries, and the normally tame Choluteca became a monster. Sweeping boulders and trees along in its path, it damaged most of the city's 18 bridges and demolished entire riverside neighborhoods.

One of those was Miramesí, the home of 250 working-class families. Late on the night of October 30, as water began to surge through the streets, community leaders went door-to-door rousing people and helping them get to higher ground. An hour and a half later most of their homes were gone. In other parts of the city hundreds drowned in their sleep, but not a single person died in Miramesí.

"That was the best moment of my life, when I led all those people to safety," said Raúl Reyes Zúniga, the community president. A young man with an old-fashioned sense of responsibility, he was among the last out of Miramesí.



DRASTIC CHANGES

Leaving a bridge high and dry six months after its inauguration, the Choluteca River takes a new route; during the storm it ran wider than normal by more than half a mile. Nearby, in what was a residential area of the city of Choluteca, scavengers collect firewood washed in by the floodwaters.



Raúl took me back to the old neighborhood in his orange pickup truck, the only thing he was able to save. Most of the site was still covered in stagnant, fetid water. A small dry section was scattered with broken bricks and roof tiles and the things of everyday life—a shoe, a doll, a refrigerator shelf. A few houses remained on a hill, and people were living in them, including Alva Felipa Moncada, a mother of five and grandmother of three.

Alva had fled with everyone else, but faced with having to spend months living in one of the local churches—a crowded, uncomfortable shelter—she had returned to Miramesí and moved in with a friend. "I'm afraid of more flooding, but what else can I do?" she asked. "There are no apartments to rent, and I can't afford to buy a house."

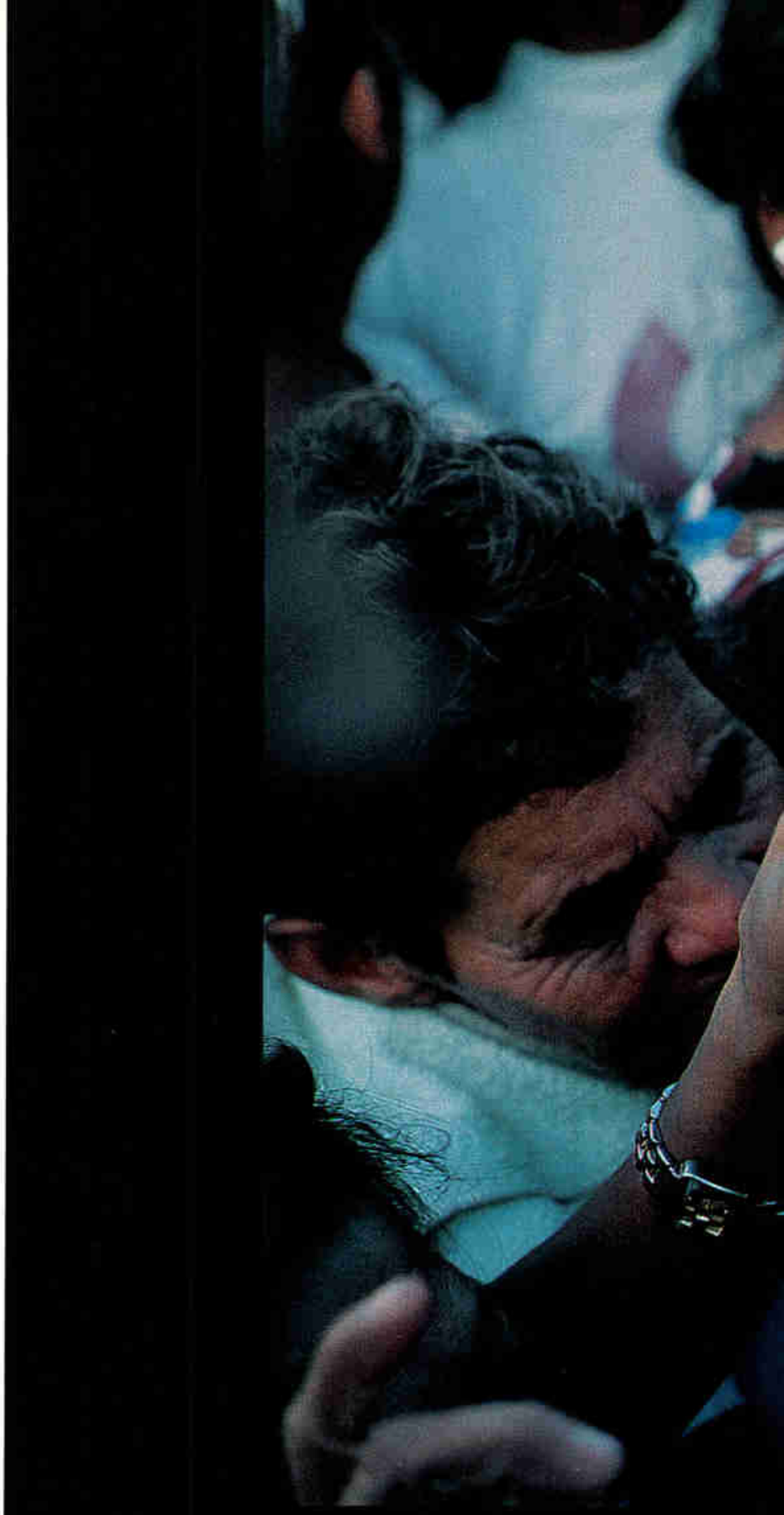
Housing has always been expensive in Honduras because the price of land is so high—farmers, business owners, and homebuilders all compete for the same limited level acreage in this mountainous country. After Mitch left 10,000 people needing new houses in the capital alone, land was like gold.

Families in Miramesí had been together for generations and were determined to relocate as a community. When they approached the city government of Tegucigalpa for help, however, it seemed there was no one willing or able to make even the smallest decision. The number of flood refugees, the extent of the damage, and the death of César Castellanos, the city's popular mayor—whose helicopter crashed during a damage-assessment flight—had created an overwhelming sense of paralysis.

As time dragged on and people in the shelters began to think about finding homes individually, Raúl Reyes and the other leaders of Miramesí decided to try to get land on their own. With the help of Michael Miller, a teacher from Missouri working to rehabilitate drug-addicted street children in Tegucigalpa, they put up a Web page and e-mailed appeals for money around the world.

"Donations came in dollar by dollar," Michael told me. "A Girl Scout troop in Atlanta sent $50. A senior citizens group in Houston sent $100. A fund-raising campaign in the Netherlands contributed $7,000."

The money was enough to buy 18 gently rolling acres on a bus route just six miles from the city, safely removed from future flooding of



"Land is the most important thing for us to have. Houses we can put up on our own," says one of the homeless people crowding in with ID cards to sign up for a private land deal near Choluteca. Two thousand families vied for 600 spacious lots. In a public project, where yards are much smaller, refugees work on one of 50 houses being built with materials donated by a U.S. church.



STARTING OVER

EMERGENCY MEASURES



With more than a hundred bridges washed out, getting around in Honduras has not been easy. At the Bonito River local workers lay a concrete footing for a temporary steel bridge that U.S. Marines put up to carry one lane of traffic until a more substantial structure can be built. Meanwhile bikers, pedestrians, and motorcyclists use a suspension bridge of rope cables and wood planks; cars and trucks drive across a ford downriver.

the Choluteca River. The original asking price for the land was $50,000, but when the three owners found out who wanted it and why, they lowered the price to $41,000. "They're good Christian people," Michael said.

On the first Sunday in February the Miramesí settlers arrived early to clear brush and thorny acacia trees from their new neighborhood, men and women alike working under a cloudy sky, swinging their machetes, fueled with the energy that comes with hope. "We see now that the Lord hasn't abandoned us despite all we've suffered," said Carmen Valladares, whose gray hair was tucked under a black baseball cap. "This place is beautiful."

"THAT RIVER STOLE THOUSANDS OF ACRES OF GOOD FARMLAND FROM US IT'S A REAL TRAGEDY."

— LITO CASTILLO

From Tegucigalpa the Choluteca flows north, then south and west to the Pacific. Bloated with floodwater and debris picked up en route, it struck the south coast with such force that it transformed the landscape—a process of eons speeded up to hours. In the city of Choluteca the river grew to more than ten times its normal width. Dumping tons of stones and sand on its new banks, it turned residential areas and melon fields into wastelands. Scouring away neat rows of ponds on shrimp farms, it created a new channel, where perhaps a third of its water ran during the storm.

"That river stole thousands of acres of good farmland from us," said Lito Castillo Galo, a business leader who surveyed the damage from the air. "Only 14 percent of Honduras was arable to begin with, so it's a real tragedy."

Before the storm more than 500 shipping containers had been lined up at the entrance to the city, ready to receive the season's first harvest of cantaloupes, honeydews, and watermelons. Some of those containers were now scattered at the river's edge, and one was wrapped around a tree; others had been deposited in fields almost 20 miles away.

"This is, let's say, our graveyard," said Arnon Faroud, the Israeli manager of the melon company Suragrícola de Honduras, the region's largest employer before the hurricane, with 12,000 on its payroll. He took me on a tour of the company's operations, driving past field after field where the waters had destroyed melons ready to be picked, ripped out irrigation tubing, and buried tractors in mud and stones.

Because so much farmland was lost here in the south—either buried under several feet of debris or washed away—Suragrícola didn't have enough work for all its employees. The hurricane's effects on his company, Arnon explained, were rippling even further through the economy. "The people we rented land from won't get their money, and the bank won't get its loan payments. It affects everyone."

Juan Custodio, the manager of a tire store on the highway through Choluteca, said his sales volume was off by 70 percent. "The melon farmers who are out of work need tires for their pickup trucks, but they have no money, so our business is suffering too," he said. "Only God knows what will happen."

At one point on our tour Arnon stopped at the jagged edge of a cliff above the Choluteca. A brand-new bridge, built with Japanese aid, stood a quarter of a mile away. It had no approaches: At both ends the flooding had swept away whole sections of road as well as the surrounding farmland. "Every time I see this, it's just incredible," he said. "I'm having to change all my standards of what a disaster is."

DOWNTOWN CHOLUTECA hadn't experienced anything like Mitch in at least a hundred years—the age of many of its adobe buildings, which melted away in the raging water. As I picked my way along mud-choked streets, several teenagers walked by with shovels over their shoulders. "We're going to dig out our school," they told me, so I tagged along.

At the school, the Instituto Superación, students were already taking mud from two internal patios—in wheelbarrows, on pieces of plywood, and by the shovelful—and dumping it in the street. "Hard work and hope are all we have," said Maribel Rodríguez de Rivas, the school's irrepressible guidance counselor.

By the time of my second visit, the school's flood-weakened facade had been replaced by cinder blocks, and workmen were installing a new tile roof. Classrooms and offices, where the mud had been several feet deep, had fresh coats of paint. And the acacia trees in the patios



AGRICULTURE SMASHED

Rivers that broke through levees and engulfed farms in northern Honduras left a lake of flattened plantains (below). In a drying banana field, laborers salvage irrigation pipes. Chiquita, their employer, lost 16,000 acres of bananas. Other cash crops such as coffee and melons were also devastated.



Miles of highway near Trujillo—and throughout the rest of Honduras—still need repair. "There's no way we can recover quickly from something this serious," says a Tegucigalpa businessman. "We're going to be fighting our way back for years."



had been pruned to let in the hot, drying sun. "We're a private institution, so the government won't help us," Maribel said. "We've had to take out a bank loan to fix everything."

For Maribel, acquiring a loan to repair her own home a few blocks away was impossible. "I need $25,000 to put it right, but with interest at 24 percent I'd have to repay $300 a month. I can't afford that now," she explained, as we walked down a street still flanked by heaps of drying dirt, our footsteps sending up yellow clouds of dust. "Because of the economy, we've lost half our students, so I'm only getting half my salary—$260 a month. I'll just have to let the repairs go for a while."

The adobe front of her house had dissolved into lumpy earth, but the solid, stuccoed rooms at the back stood firm, and she had bricked up the doorways to keep out prowlers. Half a block away two men were replacing a wall at her mother's house, where Maribel was staying. Her family wasn't about to give up.

Nor was Arnon Faroud's melon company. Fields had been replanted a safe distance from the river, and Suragrícola de Honduras was shipping its first post-hurricane crop to the winter-chilled United States. When I stopped by one evening, Arnon was at work at a packing plant awash in cantaloupes; they were rolling out of trucks into chlorine baths, out of the baths into sorting machines, and out of the sorters into boxes. "We have too many melons now," he said with a laugh. What he meant was that he had too few shipping containers, because so many had been lost in the flood.

"We lost 2,000 acres of land forever in that storm," he said. "We'll produce about 70 percent of what we did last year, but that's only because the owners of the company were willing to reinvest."

As Arnon filled a box with melons for me, I remembered something he had said in our first meeting about the way the people of Choluteca were tackling the aftermath of Mitch. It struck me as true of what was happening all over Honduras. "Individuals and companies made decisions on their own that they never would have in a developed country. Privately owned tractors and backhoes from shrimp farms worked around the clock to fix roads. And without any outside direction we had electricity from generators in just a few days. That shows this is a place people can be proud of."

As admirable as everyone's efforts have been to help the region recuperate, the fact remains that lives have been changed forever. Carlos Valdivia Camas, a friendly 30-year-old farmer, lost his entire 29 acres and most of his family in the Casita mudslide in Nicaragua. "We were going to be living so well this year," he told me



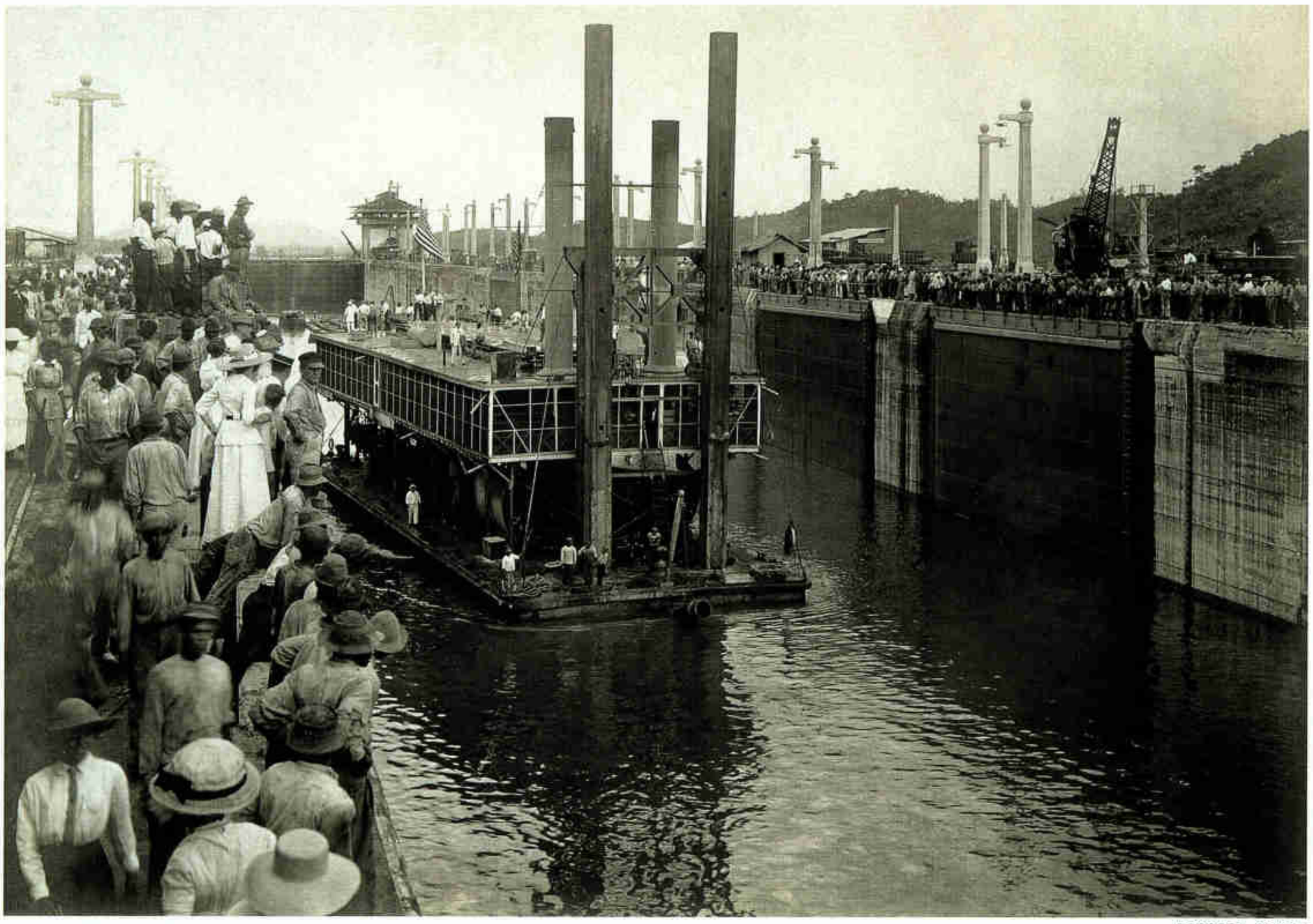
in the shelter where he was staying in Posoltega. "The harvest was wonderful, and we had plenty." Now a framed color photograph of his mother was the only thing he had left.

Like his neighbors, Carlos had no money and no prospects for a job. "Farming is all we know," he said, "and there's no other work available anyway." With no way to help himself, he was waiting to move onto one of the small plots the local government had been able to buy for hurricane refugees.

One afternoon I went with Carlos to look at the site. It was less than half the size of his ruined farm, but 150 families were supposed to live there on lots staked out at 100 by 30 feet. Above us was the scarred face of Casita. "We'd be right in front of the tiger that bit us," he said. "And how would we farm like this? Even if I have a house here, I'll have to look for a job someplace else."

People he knew were already cleaning houses in Managua and picking coffee in Costa Rica. I wondered if, like them, he would stay in Central America—or join the thousands of other refugees hoping to find better prospects in the U.S. Whatever future Carlos Valdivia makes for himself, one thing is certain: He will never escape the memory of the hurricane. □

For links to organizations providing relief to storm victims, go to *www.nationalgeographic.com/ngm/9911.*



ROSCOE E. SEARLE

■ FROM THE GEOGRAPHIC ARCHIVES

A Man, a Plan, a Canal: Panama

"There might be both a congress of nations and a congress of mosquitoes on the Isthmus," wrote staffer William Joseph Showalter in "The Panama Canal," the first of two GEOGRAPHIC articles he wrote on the subject. In February 1912 that piece ran unillustrated, but the photographs here and on the following pages—found in his office desk after his death in 1935 and never before published by the magazine—could have done the job.

The Panama Canal slices 50 miles through jungle to connect the Pacific to the Atlantic, saving ships sailing from New York to San Francisco 9,000 miles of travel around South America. Beset by malaria and bad planning, the French abandoned their hopes of carving a sea-level canal in 1898. Six years later the American government took on the project, introducing a system of locks. Cutting through the Continental Divide proved the biggest engineering challenge. A fleet of dredgers like this one (above) at Pedro Miguel Locks was kept busy pumping silt from collapsed hillsides.

S.On.S

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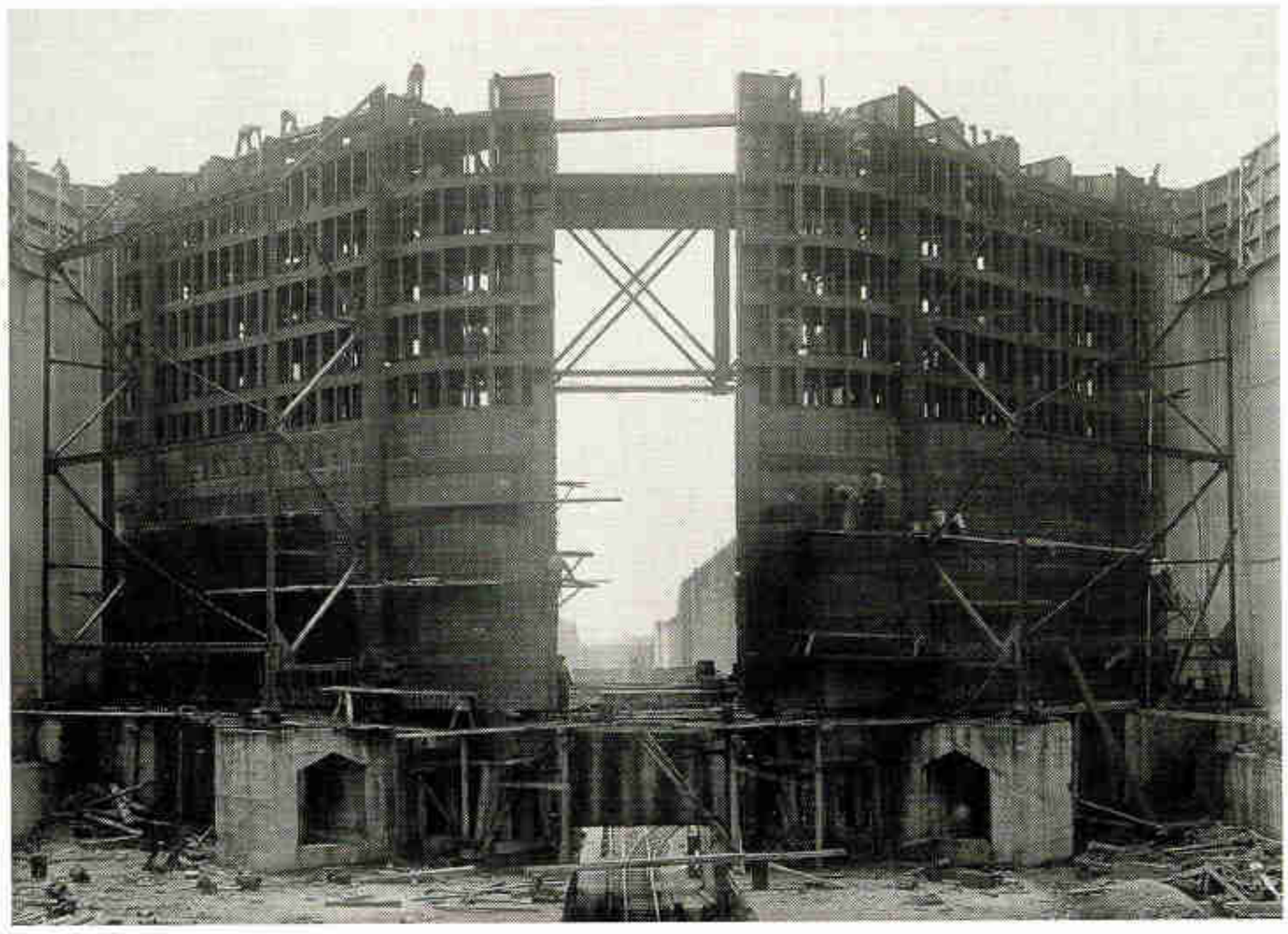
■ FROM THE GEOGRAPHIC ARCHIVES

Changing the Channel

Construction crews in 1913 had to clear frequent landslides (top) even after they completed Culebra Cut (later called Gaillard Cut) across the Continental Divide, finally making the Panama Canal navigable. In William Joseph Showalter's February 1914 article, "Battling With the Panama Slides," he wrote, "Some 19 million pounds of dynamite have been exploded in Culebra and enough material removed to make 26 pyramids, each as large as the Great Pyramid of Cheops, in Egypt." Work like that took a big shovel: A dozen men fit in the dredger *Corozal*'s "mud bucket" (below), which could dig 50 feet deep and carry 54 cubic feet of silt with each scoop.



BOTH BY ERNEST HALLEN



■ FROM THE GEOGRAPHIC ARCHIVES

Locked Up at Last

"At Panama they make artificial rock, and make it so fast that one scarcely can believe his eyes," wrote Showalter in 1912. Advances in concrete building technology made possible these 82-foot-high guard gates (above) at Gatún Upper Locks, photographed in 1911.

Spectators gathered along railroad tracks on October 10, 1913 (below), to watch workers dynamite Gamboa Dike, freeing the waters of Gatún Lake to flood Culebra Cut for its final dredging. Ten months later—after ten years of effort—the Panama Canal was complete.



BOTH BY ERNEST HALLEN

NATIONAL GEOGRAPHIC

Behind the Scenes



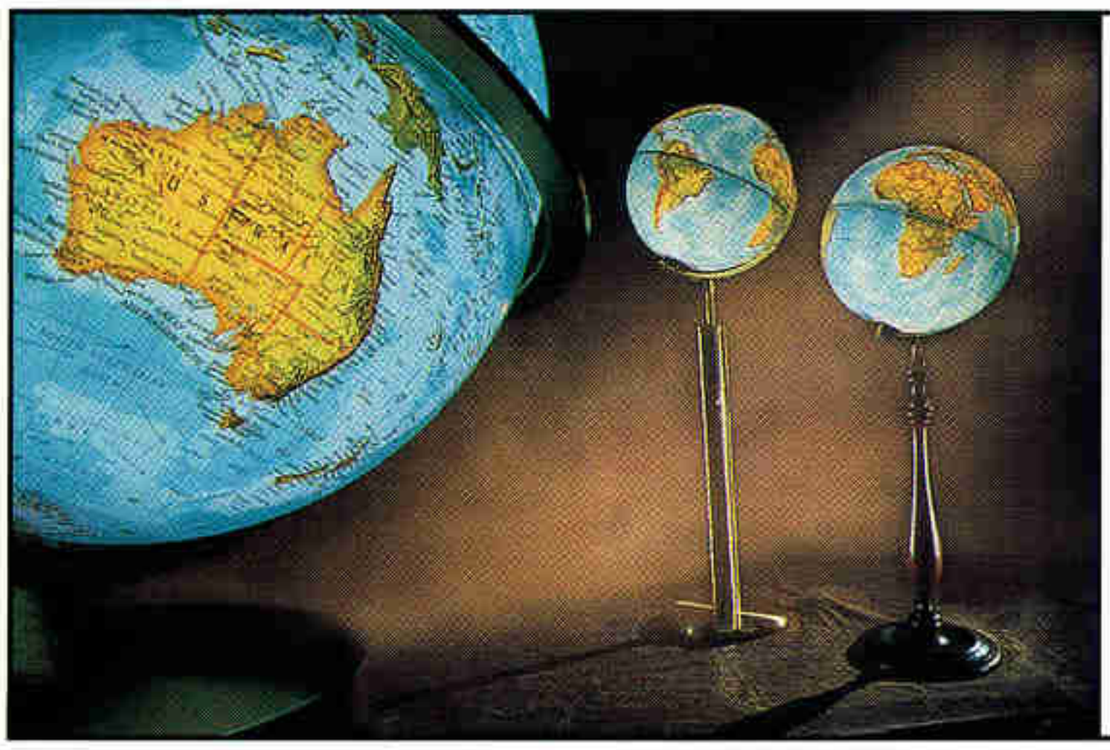
BOTH BY MARK THIESSEN, NGS

Calling on the Carpet

At age 51, Loren McIntyre—U.S. Navy officer, State Department foreign aid officer, and filmmaker—retired, only to start a new career. He became the Society's man in South America, writing and photographing articles and books on the continent over a span of three decades.

Loren's first GEOGRAPHIC assignment, on Bolivia, made the cover in February 1966. He took a copy of that issue to Ecuador on his second assignment, to help open doors. Bob Roberson, a carpet-factory owner he interviewed there, asked to keep the magazine. Loren reluctantly handed it over, not realizing he would see the cover again: on a four-by-six-foot rug (above) Roberson sent to headquarters a year later.

Unfortunately for Loren, a Society official intercepted the gift and claimed the carpet for his own office decor. The official retired, and the rug was eventually put in storage, where it remained until finally reunited with Loren for this photograph.



Thinking Globally

"They're completely redesigned, the best we've ever offered," says NG Maps' Kevin Allen of our latest illuminated globes (left). When he visited the German office of globemakers Columbus Verlag, Kevin realized our "new" association with the old family firm wasn't quite so recent. Framed on a wall was a 1960s National Geographic membership certificate belonging to the company president's grandfather.

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Lotsee, Oklahoma. Holds nine.

(The name comes from

the Indian word that means,

"Bright Child.")





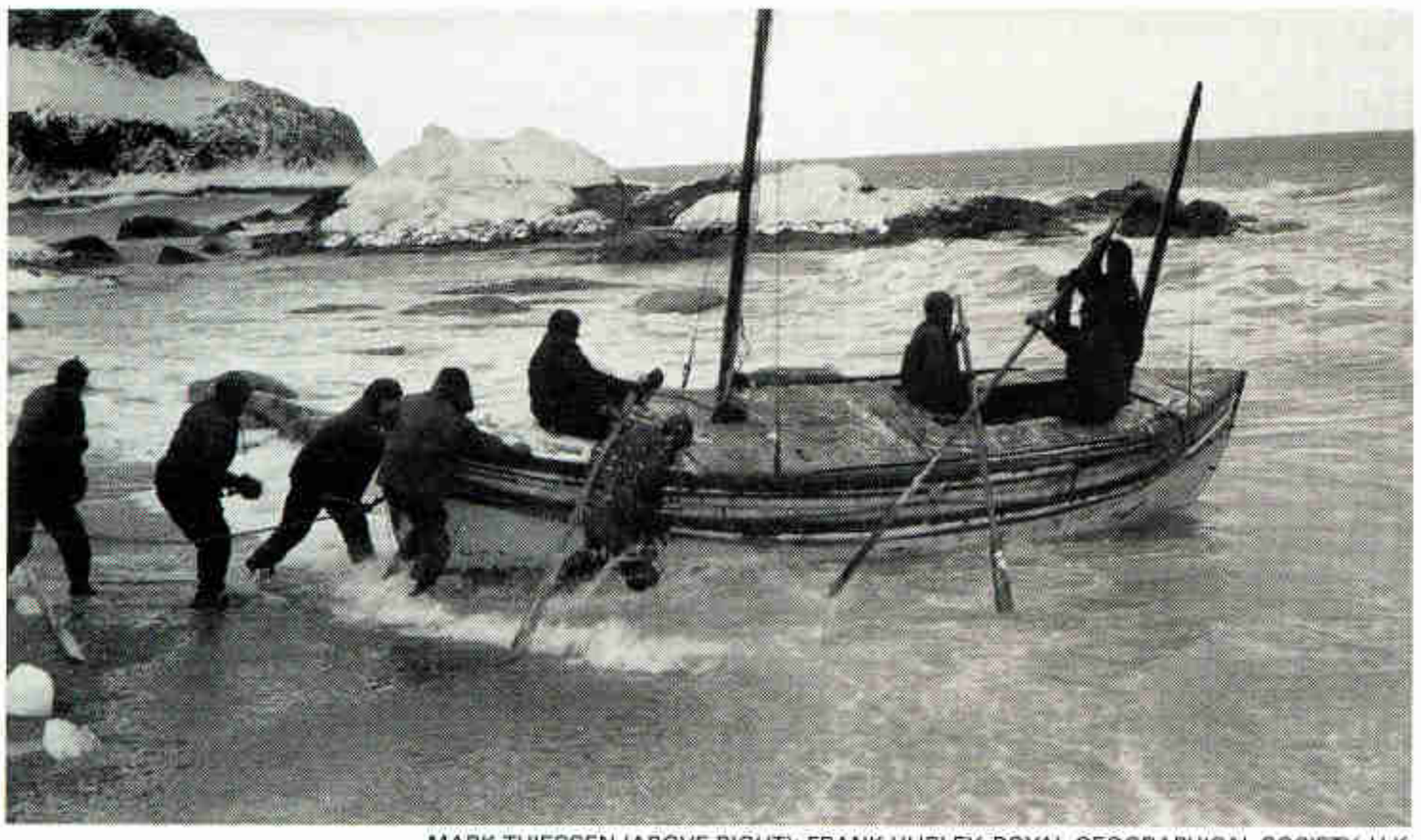
The Chevy Suburban. Holds up to nine.

(The name comes from

the American word that means,

"Bright Idea.")

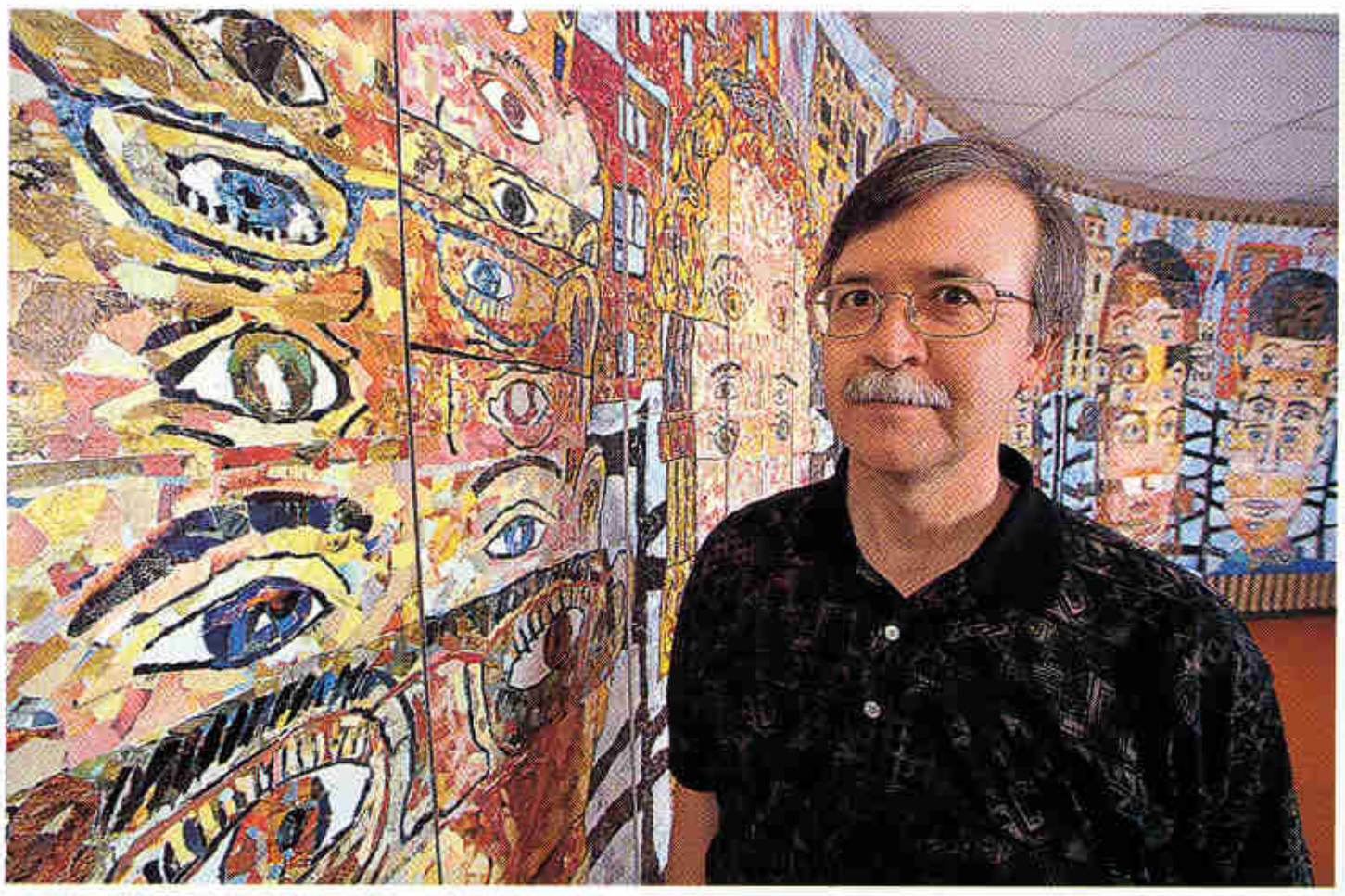
CHEVY SUBURBAN LIKE A ROCK



MARK THIESSEN (ABOVE RIGHT); FRANK HURLEY, ROYAL GEOGRAPHICAL SOCIETY, U.K.

Shackleton Lifeboat Docks at Explorers Hall

Memories of the lost ship *Endurance* live on at the Society's Explorers Hall this month in an exhibit on Sir Ernest Shackleton's Antarctic adventure, featured in the November 1998 issue. The show, organized by the American Museum of Natural History, runs until February 2000 and includes expedition photographer Frank Hurley's pictures, as well as belongings of the men who survived for ten months by eating penguin and seal and living under lifeboats after their ship was crushed by ice. The exhibit highlight is the *James Caird* (above), a $22^1/_2$-foot boat that carried Shackleton and five of his men on a desperate 800-mile journey to find help for the 22 men left behind.



KEVIN O. MOONEY

The Medium Is the Message

"I'm an artist and a social worker. I wanted to bring both things together," says Ferdinand J. Pleines (above). He planned this 23-foot-long collage celebrating ethnic diversity and founded Metromural, an organization that offers the mural as a traveling exhibit. The mural panels, created last year by 149 schoolkids in Aurora and Lincolnwood, Illinois, are made entirely of pages torn from old GEOGRAPHICS. But Pleines suspects that some young artists stretched the guidelines. "I found a picture of Leonardo DiCaprio on one panel. How'd he get there?"



Packing It to Go

After Hurricane Mitch hit Honduras last October, magazine business manager Teresa Lawrence (above) organized a relief drive for her hometown of San Marcos de Colón. Clothes were donated at drop-off points around the Society, and soon 26 boxes were off to Honduras. "I worried as I packed up. Some of the clothes were so big!" says Teresa. Where she comes from, folks run small. But her mother, who distributed the boxes in San Marcos, reports that extra-large clothes were put to good use—as bedding.

The Society helped sponsor a concert featuring fiddler Bonnie Rideout, then matched the proceeds. The result was $50,000, sent to Habitat for Humanity's Central American fund.

TEXT BY
MAGGIE ZACKOWITZ

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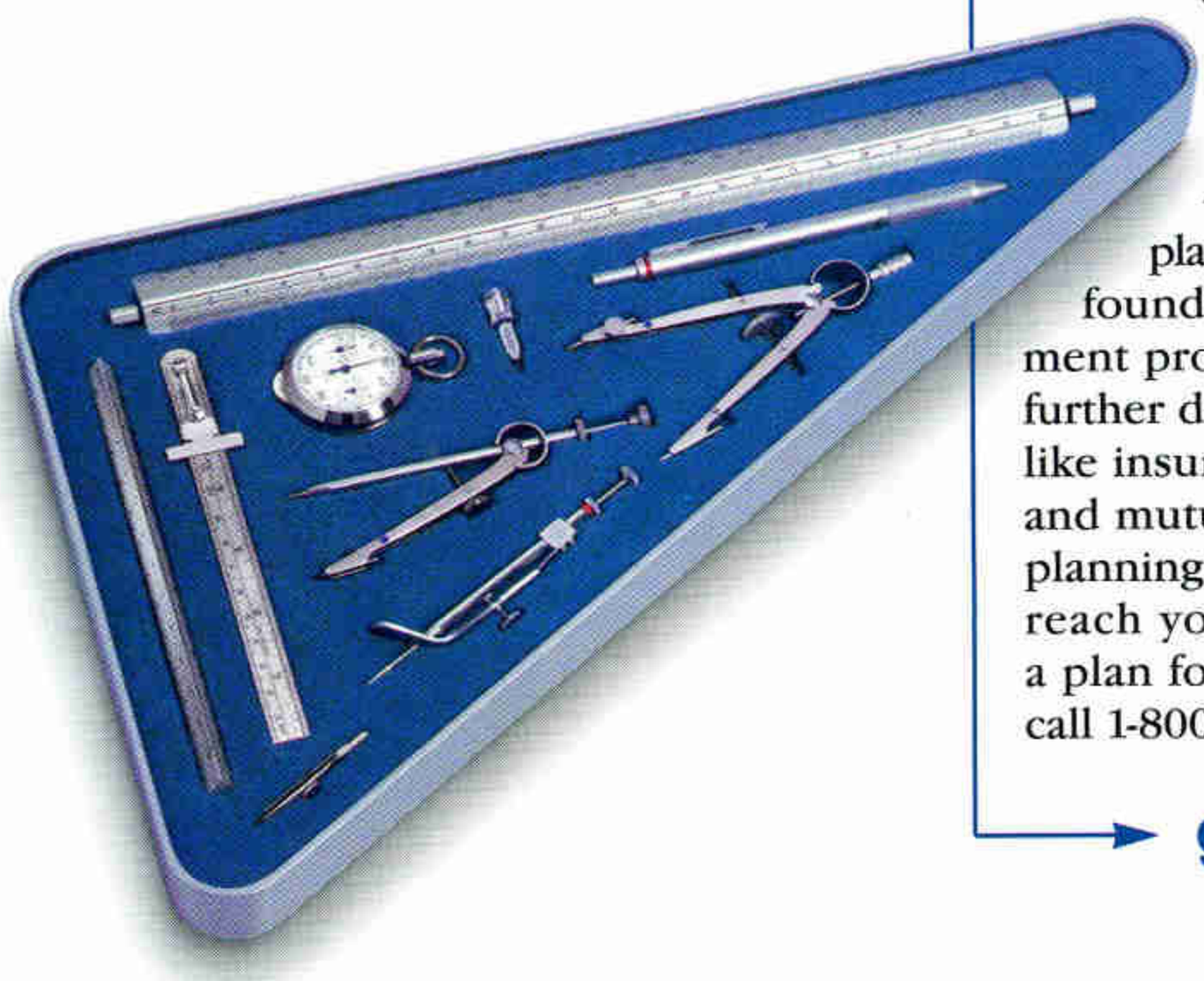
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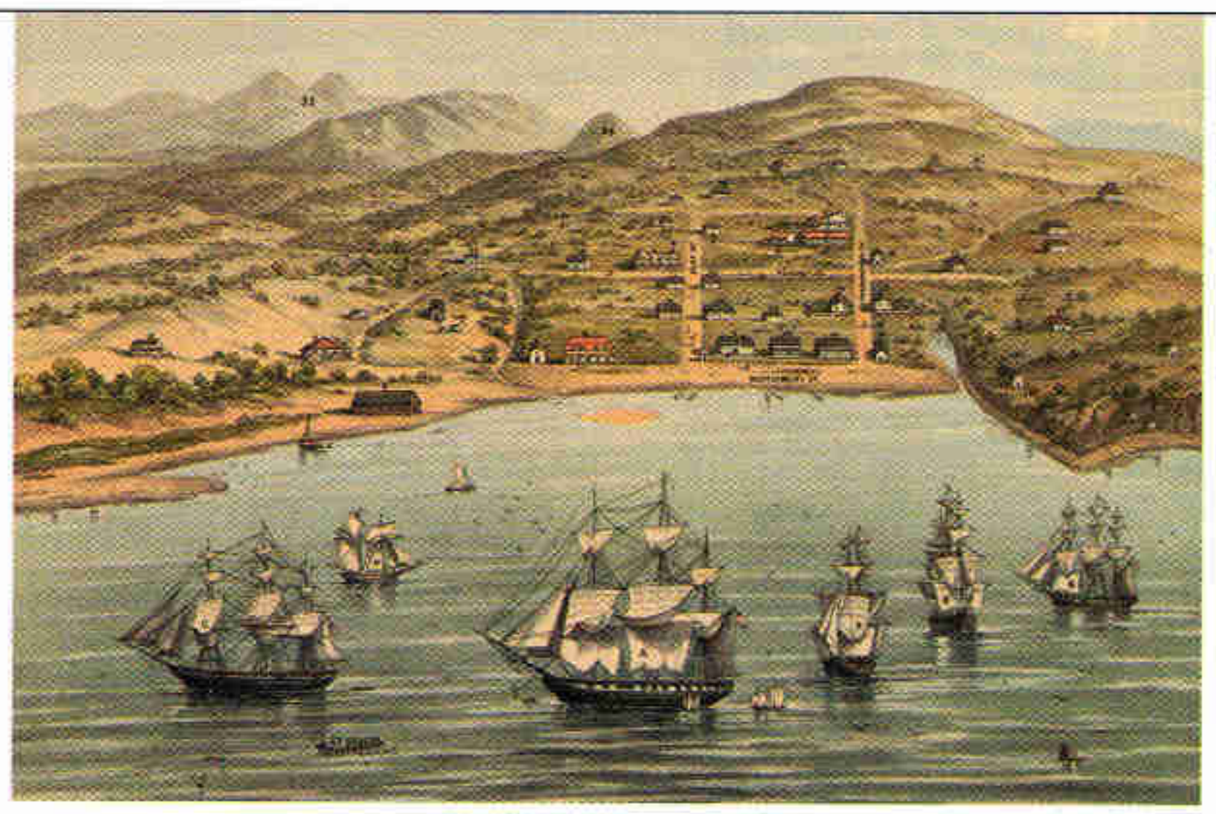
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NATIONAL GEOGRAPHIC

CartoGraphic

Panoramic Maps Depict 19th-century Urban Sprawl



One hundred fifty years ago this fall, gold seekers by the thousands were pouring into California in covered wagons and square-riggers. Although relatively few of the forty-niners actually struck gold, their arrival changed the course of American history—and transformed San Francisco almost overnight from a village to a metropolis.

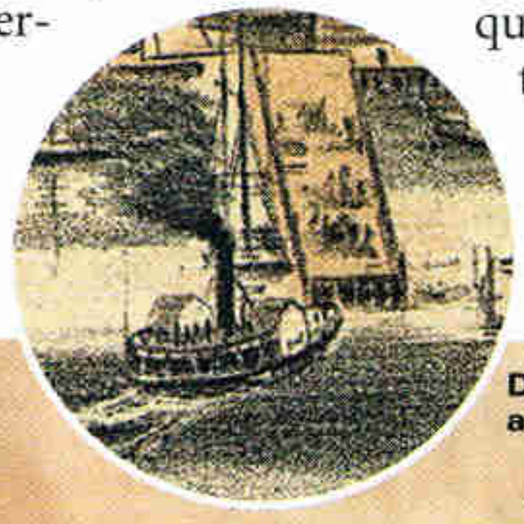
The "bird's-eye views" shown here dramatize that change. The panoramic map above depicts San Francisco as it appeared shortly before gold was discovered less than a hundred miles from the port in January 1848.

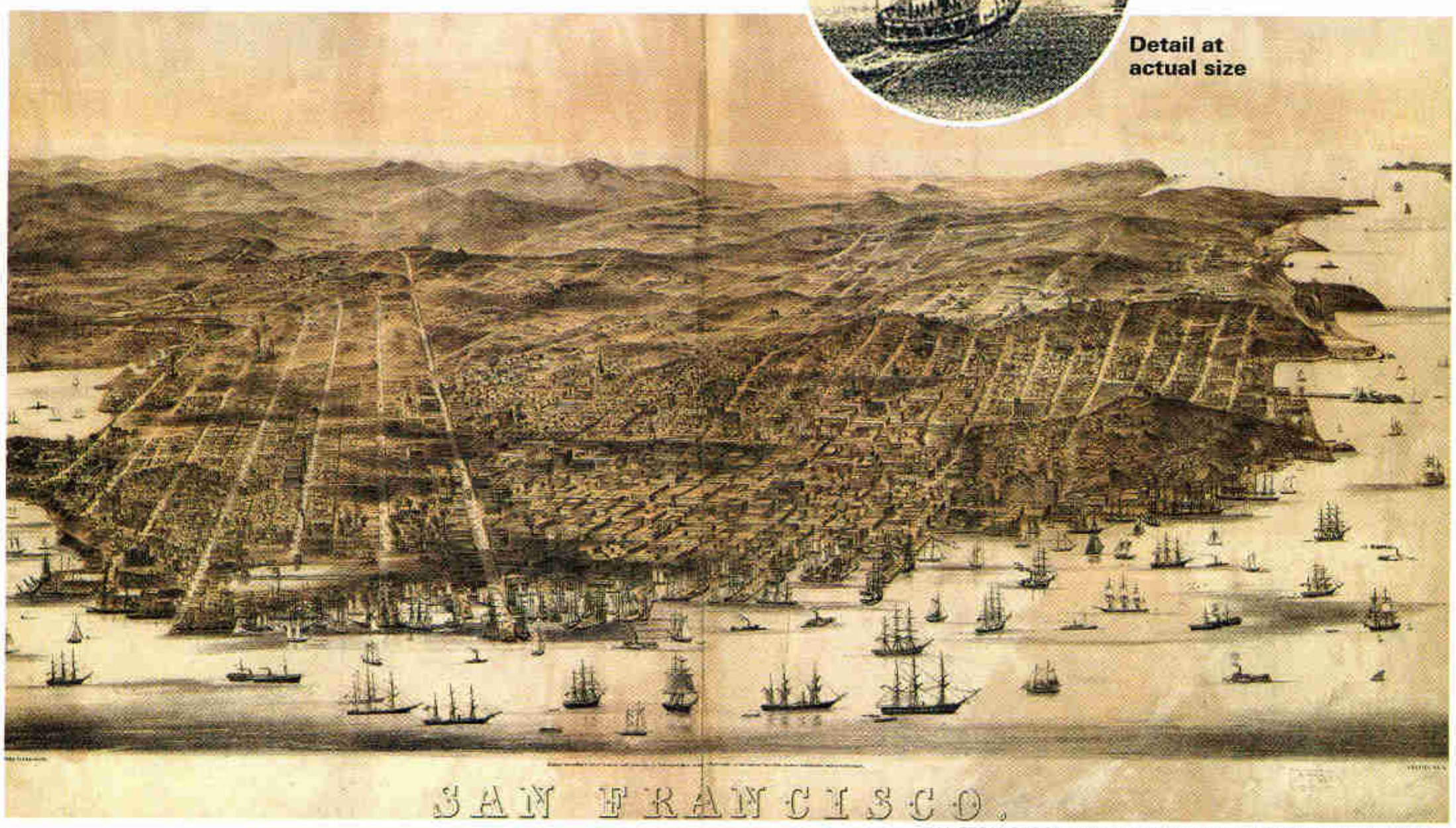
At the height of the gold rush the city boasted an average of 30 new houses—and two murders—a day. By 1864 (below) the city had survived a series of devastating fires and sprawled across its famed hilltops.

In the decades following the Civil War, civic boosterism created a demand for urban panoramas, which local and itinerant artists were happy to satisfy. More than 2,000 American cities and towns were depicted in this fashion, from remote railroad stops on the High Plains to smoke-wreathed factory towns of the East. The panoramas provide a rich and beautiful record of America's growth from agrarian backwater to industrial powerhouse.

Some 1,700 of these maps reside in the vast collection of the Library of Congress. Fortunately, browsing this trove no longer requires a visit to Washington, D.C. More than a thousand city panoramas are on the library's "American Memory" website *(http://memory.loc.gov)*, part of an ambitious program that will eventually bring thousands more high-quality map reproductions to the Internet.

TEXT BY
ALLEN CARROLL
Chief Cartographer





Detail at actual size

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Photo by Larry Dale Gordon

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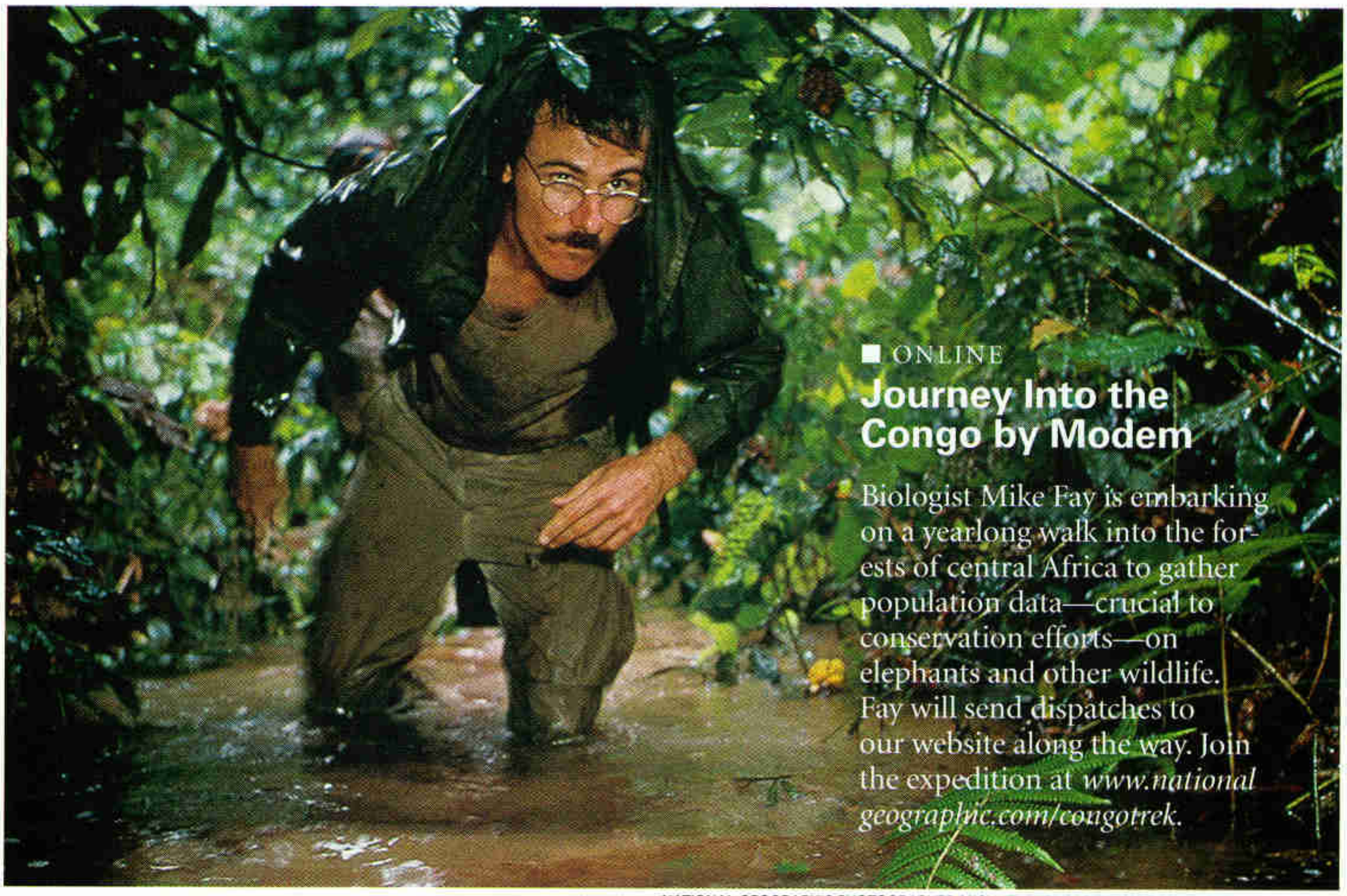
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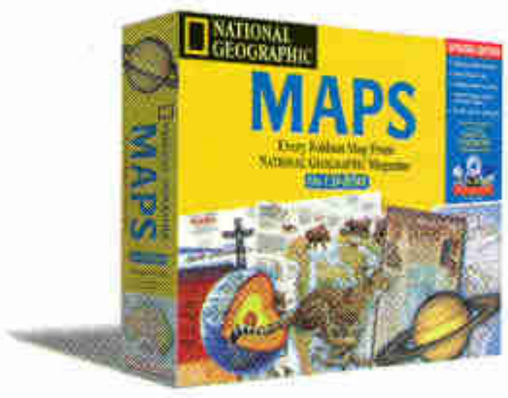
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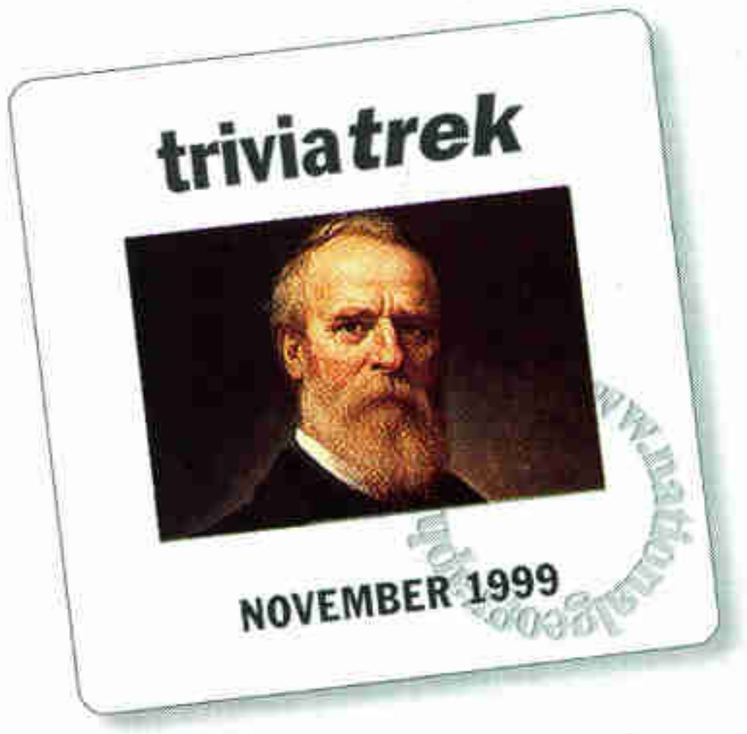
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